



COCHIN SHIPYARD LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)

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Tender for:

CONSTRUCTION OF MULTI-STOREY(G+11) EMPLOYEES RESIDENTIAL QUARTERS AT CHERIYAKADAVATHRA

File No. CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/
G+11 EMPLOYEES QUARTERS/2026/2

Date: 05.05.2026

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS/2026/2.

**CONSTRUCTION OF MULTI-STOREY(G+11) EMPLOYEES
RESIDENTIAL QUARTERS AT CHERIYAKADAVATHRA**

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Date: 05.05.2026

E-TENDER NOTICE

Percentage rate competitive e-tenders are invited through the e-tendering CPP Portal on behalf of Cochin Shipyard Limited (CSL) from experienced contractors for the under mentioned work, so as to reach the undersigned on or before the date and time mentioned below:

Name of work : Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra.

Estimate Amount : ₹ 47,80,34,000/- (Including GST @ 18%)

Earnest money to be deposited : ₹ 57,80,000/-

Tender processing Fee : Nil

Publishing date & time : 05.05.2026 at 15.30 hrs.

Pre Bid meeting date and time : 15.05.2026 at 10.00 hrs.

Pre-bid meeting place : Safety Training Centre, CSL, Cochin

Bid document download date & time : 05.05.2026 at 15.30 hrs.

Clarification Start date & time : 05.05.2026 at 15.30 hrs.

Clarification end date & time : 28.05.2026 at 11.00 hrs.

Bid submission start date & time : 05.05.2026 at 15.30 hrs.

Bid submission end date & time : 28.05.2026 at 11.00 hrs.

Bid Opening Date & time : 29.05.2026 at 11.30 hrs.

Time of completion of work : 30 months

Short description of work : Work involves construction of a multi-storied (Ground + 11 floors) residential housing project including piling / foundation works, RCC framed structure, associated civil works till finishing, sanitary and plumbing works, fire fighting works, sewage treatment plant, mechanical/electrical works, fresh/rain water tanks, structural fabrication, passenger / service lifts, other infrastructure facilities and clearing the site and handing over the completed building in all aspects with a built-up area of approx. 8144 sqm.

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Technical Bid containing documents as per Para 6 (A) (uploaded by the tenderers) shall be opened on date & time mentioned above. Tenderer have to submit EMD as per clause 5 of special condition of contract.

If any clarification is needed from the tenderer about the deficiency in his uploaded documents in technical Bid, he will be asked to provide it through CPP Portal or email if required. The tenderer shall upload the requisite clarification/documents within time specified by CSL, failing which it shall be presumed that bidder does not have anything to submit and bid shall be evaluated accordingly.

The intimation regarding acceptance/rejection of their bids will be intimated to the tenderers through CPP portal.

Financial Bid containing financial bid of the tenderers found to be meeting the technical criteria and qualifying requirements shall be opened later after intimating tenderers through CPP Portal. The financial bid shall contain documents as per Para 6 (B)

(In case the date and time for opening of financial bid is required to be changed, the same shall be intimated through CPP Portal).

The tendering process is online at CPP-portal URL address <https://etenders.gov.in/eprocure/app>. Prospective tenderers may download and go through the tender documents.

Sd/-

Deputy General Manager (Civil)

Signature of the Contractor

SPECIAL CONDITIONS

File No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS/2026/2

**CONSTRUCTION OF MULTI-STOREY (G+11) EMPLOYEES RESIDENTIAL
QUARTERS AT CHERIYAKADAVANTHRA**

1. The conditions enumerated below are in addition to and will have precedence over “the General conditions of contract given in “Conditions of contract and instructions to Tenderers of CSL”.
2. “General Conditions of Contract and Instructions to Tenderers” is available in the CSL website. The tenderer shall submit their tender documents including GCC. Although, it is permissible to submit the tender without the copy of GCC, while entering into agreement by the successful tenderer, the GCC shall be duly signed by both the parties and form part of the agreement. As such, it is deemed that the tenderer has made reference to the GCC in the website or otherwise, and has full knowledge of its contents, although it is not signed and attached with the tender.
3. The tendering process is online at CPP-portal i.e. E-tender (URL address <https://etenders.gov.in/eprocure/app>), and other modes of tender submission will not be accepted. All corrigendum, addendum, amendments and clarifications to Tender Specifications will be hosted only in the website <https://etenders.gov.in/eprocure/app>. Bidders shall keep themselves updated with all such developments till the last date and time of submission of tender.
4. The bidder shall not be black listed or de-registered by any Central / State Government Department or Public Sector Undertaking (PSU's) etc.
5. EMD for the work is ₹57,80,000/-. The EMD for this work will be accepted online or in the following forms:
 - 5.1 Demand Draft of a scheduled bank drawn in favour of Cochin Shipyard Ltd.
 - 5.2 Fixed Deposit Receipt from a scheduled bank and shall be pledged in favour of Cochin Shipyard Ltd.
 - 5.3 Bank Guarantee, from a Nationalized Bank or Scheduled bank in India as per the format provided in the GCC (Refer Page 81 of GCC). The Bank Guarantee shall be kept valid up to 3 months after the due date of submission of tender and encashable at Kochi.

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5.4 NEFT / RTGS /Online payment to CSL bank account. UTR number of the transaction to be submitted.

CSL Current Account No: 10319928321

IFSC code : SBIN0003229

Beneficiaries Name: Cochin Shipyard Ltd

Bank : State Bank of India.

The Details of EMD to be submitted along with technical bid. The original EMD shall be submitted in the office of Engineer-in-Charge before the date and time fixed for opening of tender. In case of NEFT, UTR details to be submitted (mentioning UTR number / transaction No, date and time of transaction, Bank etc). The EMD shall be retained with Cochin Shipyard Limited till finalization of bids. EMD will not carry any interest.

6. The tender for the work will be based on two bid system. The tender has to be submitted in two bid as detailed below

(A) Technical Bid

Technical Bid should contain the following signed documents:

- i. Duly signed NIT, Special conditions, technical specifications, GCC, Tender drawings.
- ii. Proof of submission of EMD as per Clause-5 above.
- iii. Checklist as per Annexure-1.
- iv. Schedule of Completion Annexure-2
- v. Details of Bidder as given in Annexure-3.
- vi. Bid Security Undertaking as per Annexure-4 (To be submitted in the contractor's letter head duly signed).
- vii. GST Undertaking as per Annexure-5 (To be submitted in the contractor's letter head duly signed).
- viii. E-payment details (duly filled) as per Annexure-6 (For First time vendors).
- ix. Performa of Schedules as given in Annexure-7
- x. Undertaking by bidder' as given in Annexure-8
- xi. Procedure to be followed for obtaining entry passes for contract workers Annexure-9.
- xii. Pre Contract Integrity Pact as per Annexure-10
- xiii. Bank Guarantee in lieu of EMD Annexure-11

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- xiv. Proforma of power of attorney / Letter of Authority as per Annexure-12 (To be submitted in the contractor's letter head duly signed).
- xv. Rewards and Reprimands Annexure-13
- xvi. List of key personal for the execution of work as per Annexure-14
- xvii. Candidate summary as per Annexure-15
- xviii. List of plant and machinery as per Annexure-16
- xix. Criteria for evaluation Annexure-17
- xx. Financial Turnover (duly filled) as per Annexure-18
- xxi. Solvency Certificate Annexure-19 (from Banker).
- xxii. Bank Guarantee in lieu of PG/SD Annexure-20
- xxiii. List of instruments and equipments for laboratory Annexure-21
- xxiv. Work experience record as per Annexure-22 with required documents supporting the same satisfying the requirements as specified in clause No.7.
- xxv. Schedule of completion / Program Chart Annexure-23
- xxvi. Quality Assurance Plan as per Annexure-24
- xxvii. Scanned Copy of Permanent Account Number (PAN) and GST Registration Number.

(B) Financial Bid

The bidder shall quote the percentage with maximum 2 decimal digits above / below the rates in the format provided and no other format is acceptable. SGST @ 9% and CGST @ 9% shall be paid over and above the accepted rates as per GST rules.

If the price bid has been given as a standard BOQ format with the tender document, then the same is to be downloaded and to be filled by all the tenderers. Tenderers are required to download the BOQ file, open it and complete the unprotected cells with their respective financial quotes and other details (such as name of the tenderer). No other cells should be changed. Once the details have been completed, the tenderer should save it and submit it online, without changing the filename. If the BOQ file is found to be modified by the tenderer, the bid will be rejected.

(C) Bid Submission:-

- i. The tenderer shall submit their application only at CPP Portal: <https://etenders.gov.in/eprocure/app>. Tenderer/Contractor are advised to follow the Signature of the Contractor

- instructions provided in the tender document for online submission of bids. Tenderers are required to upload the digitally signed file of scanned documents as detailed above. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.
- ii. Uploading of application in location other than specified above shall not be considered. Hard copy of application shall not be entertained.
 - iii. Tenderer who has downloaded the tender from Central Public Procurement Portal (CPPP) website <https://etenders.gov.in/eprocure/app>, shall not tamper/modify the retender form including downloaded price bid template in any manner. In case if the same is found to be tampered/modified in any manner, tender will be completely rejected and tenderer is liable to be banned from doing further business with Cochin Shipyard Ltd.

7. **PRE QUALIFICATION CRITERIA**

Price bid of the responsive bidders who are qualified the techno-commercial evaluation will only be opened. Selection criteria for qualifying the tenderers for opening the price bids in Cover 'B' of the tender will be as below:

I) EXPERIENCE:

The bidder should have experience of having successfully carried out similar works during last 7 years ending with the date of submission of tender should be either of the following:

- (i) Three similar works, EACH work costing not less than ₹19.00 Crores.

OR

- (ii) Two similar works, EACH work costing not less than ₹24.00 Crores.

OR

- (iii) One similar work costing not less than ₹38.00 Crores.

Explanatory notes: Similar work(s) means having satisfactorily carried out construction of minimum seven storey building executed in India in a single contract comprising of piling / foundation works, fabrication, superstructure, MEP, firefighting, finishing and all associated civil works.

Signature of the Contractor

The tenderer shall furnish attested documents in proof for their experience. Original completion certificate and work order to be produced for verification if requested by the Engineer-in-charge.

For works undertaken at Cochin Shipyard Ltd, copy of work order and last paid bill can be submitted as documental evidence.

In case of experience from private sector, attested documents of work completion certificate and relevant TDS certificates for the value of work done shall be submitted as documental evidence.

Completed portion of ongoing work till last month of submission of the bid for which payments have been already processed will be considered against experience on submission of certificate of satisfactory completion of the portion of work from the owner of the work.

Following enhancement factors will be used for the costs of works executed for bringing the financial figures to a common base value in respect of the works completed in the past years.

Year before	Multiplying factor
One year	1.07
Two years	1.14
Three years	1.21
Four years	1.28
Five years	1.35
Six years	1.42
Seven years	1.49

Enhancement factor will not be applicable for the quantity of work done.

II) FINANCIAL TURNOVER:

Average Annual Financial Turnover of the tenderer during the last three financial years ending on 31st March 2025 shall not be less than ₹14.00 Crores. A notarized copy of audited balance sheet and profit & loss account for the preceding 3 years has to be submitted in proof of financial turn over. Year in which no turnover is shown would also be considered for working out the average financial turnover per annum.

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III) SOLVENCY:

The tenderer shall furnish Solvency certificate for an amount not less than ₹14.00 Crores from a Nationalized or Scheduled Bank and issued within a period of 12 months from the final date of submission of tender (Annexure-19).

IV) PERSONNEL CAPABILITY AND EQUIPMENTS / MACHINERY FOR EXECUTING THE WORK:

The bidder shall furnish details of technically qualified personnel in their employment to be deployed for the above work, if awarded, as per the proforma at Annexure-14 & 15. The bidder shall also furnish the details of equipments / machinery to be deployed for the above work, if awarded, as per the proforma at Annexure-16.

V) BID CAPACITY:

The bidder will be qualified only if the bid capacity of the bidder is equal to or more than the total estimated cost of the work put to tender. The bidding capacity will be calculated as under.

$$\text{Bid Capacity} = \{ [A \times M \times N] - B \}$$

Where,

A = maximum value of works executed in any one year during last five years (updated to current price level), taking into account completed as well as work in progress.

M= Multiplier factor (usually 1.5)

N = The period of this contract in years (2.50 years)

B = Value of current price of existing commitments and ongoing works to be completed during the period of completion of this work (N years).

Note: Item 'B' stated above should be substantiated with proper records & evidences.

Bidders who meet the bid capacity equal to or more than the total estimated project cost shall only be qualified.

VI) PRE CONTRACT INTEGRITY PACT

Integrity Pact as per Annexure-10 to be duly signed and enclosed along the tender.

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8. **EVALUATION CRITERIA**

The bidders qualifying the pre-qualification criteria as per Clause-7 above will be evaluated for following criteria by scoring method on the basis of details furnished by them in the following manner:

- (a) Financial strength – Maximum 30 marks
- (b) Experience in similar nature of work during last 7 years - Maximum 40 marks
- (c) Personnel and Establishment – Maximum 15 marks
- (d) Plant & Equipment - Maximum 15 marks

Total - 100 marks

To become eligible for short listing, the bidder must secure at least fifty percent marks in category (a) and (b) of Annexure-17 and sixty percent marks in aggregate. The marking system for evaluation will be as given in Annexure-17.

9. Joint Venture Company / Consortium of Companies will not be permitted to participate in the tendering process.
10. The tenderers shall have to sign in each page of the tender documents with official stamp as a token of his acceptance of the conditions stated therein.
11. During the evaluation of the tender, Engineer-in-Charge may at his discretion ask the bidders for submission of shortfalls through e-tender portal. Clarifications sought shall be uploaded by the bidders within the date and time specified. In case of non-submission of the documents through the e-tender portal the tender submitted will be summarily rejected.
12. CSL reserves the right to open Financial Bid (Price Bid) of only those bidders whose Technical & Commercial bids are acceptable and complete on a later date. CSL's decision in this regard shall be final and binding on the bidder. The Financial Bid (Price Bid) of bidders whose technical and commercial aspect is not acceptable or is incomplete will be rejected.
13. The acceptance of a tender will rest with DGM(CE) / Engineer-in-Charge who does not bind himself to accept the lowest tender and reserves to himself the authority to reject any or all of the tenders received without assigning any reason.
14. The tenderers are expected to have inspected the site, before quoting, read the conditions thoroughly and understand the works in all respect. Clarifications, if any may be obtained from the Deputy General Manager (Civil) before the tender is submitted, and if clarifications/details are not obtained before the tender is submitted, no claim on this account will be

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admitted. The submission of a tender by tenderer implies that he has read these tender conditions and General Conditions of Contract and has made himself aware of the scope and specifications and other factors bearing on the tender.

15. The tenderer should keep open the validity of the tender for 90 days from the date fixed for its opening or from the date of its opening whichever is later. If the tenderer withdraws his tender before the validity period or makes any modifications in the terms and conditions of the tender which are not acceptable to CSL, tender will be completely rejected and tenderer is liable to be banned from doing further business with Cochin Shipyard Ltd.
16. Cochin Shipyard Ltd. shall without prejudice to any right or remedy is at full liberty to forfeit the said EMD absolutely if the tenderer withdraws his tender before the validity period or makes any modifications in the terms and conditions of the tender which are not acceptable to CSL. After the issue of work order by CSL, failing / refusing to execute the agreement / start the work, the tenderer shall be deemed to have abandoned the contract and such an act shall amount to and be construed as the contractors calculated and the willful breach of the contract, CSL shall have full right to take suitable action against the firm together with forfeiture of Earnest Money Deposit.
17. The bid shall be on percentage rate basis. The percentage rate shall apply equally on all items. The rates shall be for finished items of works including supplying and costs of materials, labour, equipment/ tools, scaffolding, conveyance, loading / un-loading, storing, handling etc. all complete, unless specified in the tender schedule.
18. The rates quoted by bidder shall remain firm till completion of all works even during the extended period, if any, on any account what so ever.
19. Price bids shall be evaluated based on overall total amount. Normally CSL will award the contract to the bidder whose bid has been substantially responsive to the bidding documents and who has offered lowest evaluated total amount. CSL reserves the right to conduct negotiations with L1 contractor to have possible reduction from the original offer or if the condition so warrants. The bidder shall attend the negotiation meeting in time upon intimation to them by CSL. Normally the work will be awarded to the L1 bidder if acceptable.
20. Contractors registered under the GST act should only participate in the tender. The bidder (Contractor) shall furnish a copy of the GSTIN (GST Registration No.), PAN number etc.

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allotted to him. The Provisional GST ID of Cochin Shipyard Ltd. is 32AAACC6905B1ZD and the address of the registered place of business of CSL is “Administrative Building, Perumanoor, Cochin - 682 015”.

21. It will be mandatory for the bidders to indicate their bank account numbers and other relevant E-payment details so that payments could be made through ECS/NEFT/RTGS mechanism instead of payment through cheques, wherever feasible. The bidders are required to duly fill the NEFT format at Annexure-6 and submit a cancelled cheque along with the tender.
22. The successful tenderer will be required to execute an agreement at his expense on proper value Kerala State Stamp Paper in the prescribed departmental form. Till signing of agreement, this tender together with your written acceptance / work order thereof shall constitute a binding contract between the bidder and CSL.
23. The contract shall come into effect on the date of signing of both the parties on the agreement (effective date) and shall remain valid until the completion of the obligation of the parties under the contract.
24. The successful tenderer shall deposit an amount equal to 5% of contract value as Performance Guarantee (PG) in the form of Demand Draft or Fixed Deposit Receipt (FDR) of a Nationalized Bank or Scheduled Bank in India and shall be pledged in favour of Cochin Shipyard Ltd. payable at Kochi or irrevocable Bank Guarantee (BG) in the prescribed form Annexure-20, FDR (lien in favour of CSL). The performance guarantee shall be valid up to 3 months after the scheduled date of completion of the work. The time allowed for furnishing of performance guarantee should be 21 days from the award of work. Delay in furnishing will be liable for a late fee at the rate of 0.1% of the guarantee amount per day for a further period of 21 days. Failure to furnish the performance guarantee beyond the above period will make the contract liable for cancellation and forfeiture of EMD without further notice. The performance guarantee shall be refunded to the contractor soon after the successful completion of the work and recorded completion certificate.
25. The Security Deposit (SD) will be collected from each running bills / final bill at the rate 5% of the value of work done in addition to the performance guarantee. Security deposit will be released only after attending all the defects pointed out to the contractor during the defect liability period. Any work which is not attended/replaced during the defect liability period within a reasonable time given by Engineer-in-Charge, the work will be carried out at the risk

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and cost of the contractor by CSL. Security Deposit will not accrue any interest. The security deposit will be released after the successful completion of defect liability period as per Clause 2 of GCC.

26. If the contractor abandons the contract or fails to commence the work in time or suspend the work for long duration (15 days) or delay the progress of the work without valid reasons acceptable to CSL or labour dispute with their workers or poor safety records etc., CSL will terminate the contract and arrange the work at the risk and cost of the contractor. In such case Performance Guarantee and Security Deposit will be forfeited accordingly.
27. EMD of unsuccessful bidders will be released after the checking of the price comparative statement by Finance Department. EMD of the successful bidder will be released on receipt of Performance Guarantee (PG) or adjusted against Security Deposit recovery during settlement of bills.
28. The time of completion of work is 30 months, which will be reckoned from the 14th day from the date of issue of work order or the date of handing over the site whichever is later. The time allowed for carrying out the work shall be strictly observed by the contractor. The work shall throughout the time period be preceded with diligence keeping in view that time being deemed to be the essence of the contract. The completion of works shall be as per the schedule of completion given in Annexure-2. If the contractor fails to complete the work, compensation for delay as per Clause 2 of GCC will be applicable and no extension of time will be allowed by Cochin Shipyard Limited. When the site is handed over in Phases with separate period of completions, delay compensation as per clause 2 of GCC will be levied on the value of the phase of which completion is delayed. Hence, contractor shall make necessary arrangements for the procurement of materials and mobilization of manpower, machinery etc. in advance to complete the work as per the target. No additional time will be granted by Cochin Shipyard Limited on any accounts.
29. The contractor shall submit a detailed time schedule / program chart of work in conformity with the completion time and to achieve the milestones as per the schedule of completion within 14 days from the date of issue of letter awarding the work. This shall be got approved by the Engineer-in-charge or revised as directed by the Engineer-in-charge.
30. The time allowed for the work is inclusive of rainy season prevailing in Kerala. The contractor shall take note of the situation while quoting. No extra rate will be admissible

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and it shall be the contractor's responsibility to keep the construction site free from water at their own cost.

31. The defect liability period of this contract is 24 (twenty four) Months from the recorded date of completion of this contract. The Observation Period means the defect liability period. The contractor has to make good all the defects observed during the observation period at his own expenses. If the defects are not attended for a longer period of time the work will be arranged by CSL and the amount incurred will be deducted from the security deposit retained.
32. The successful bidder (contractor) shall not transfer or assign the work to any other agency nor shall transfers be made by the "Power of Attorney" authorizing others to carry out the work or receive payment on behalf of the contractor. In case any specialized part of the work is carried out through other agencies, the liabilities of those works shall lie with the principal Contractor.
33. The contractor is expected to acquaint himself with the site conditions, labour situation, wage and benefits applicable to labourers, working hours, out turn of work by labour and the fluctuations which are likely to happen till the work is completed on all the above aspects prior to quoting the rates. The submission of a tender by tenderer implies that he has made himself aware of all the above situations and conditions. Any extra claim on this account will not be entertained.

34. **Payment Terms:**

I. CIVIL WORKS

- a) Payments (Part Bills / Final Bills) shall be based on the bill submitted by the contractor and acceptance of the bill by CSL. Bill as per GST Act should be furnished. The detailed measurements shall be taken jointly by CSL and contractor and detailed measurements prepared shall be submitted along with the bill. The final bill shall be paid within three months from the date of submission of the claim (bill) by the contractor or date of acceptance of bill by both the parties whichever is later. The bill claim (part bill / final bill) shall be submitted by the contractor only after joint measurement.
- b) For the completed items of the work 75% of the net amount payable on each bill can be paid as advance by CSL at the discretion of Deputy General Manager (Civil) on a request by the contractor and a recommendation of the Engineer-in-Charge and production of an

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undertaking on approved format by the contractor. Balance amount will be paid after scrutiny and check of the bill.

II. ELECTRICAL WORKS

a) For point wiring, circuit wiring, ELV cabling, payment shall be (for Sl no. 215.01 to 215.08, 227.01 to 227.04).

- 15% after slab conduiting works.
- 40% after completion of cable laying.
- 40% against Switch socket fixing, termination, Testing & Commissioning.
- 5% immediately after final handing over of the complete project.

b) For all other electrical items payment issue shall be

- 60% against supply of the materials.
- 20% against installation.
- 15% against Testing & Commissioning.
- 5% immediately after final handing over of the complete project.

35. Secured Advance shall be given for TOR steel as provided in Clause 14 (i) of Clauses of Contract in GCC. Secured advance shall be paid against Bank Guarantee and manufacturer's test certificate. Decision of the Engineer-in-Charge to this aspect will be final. Any material advance given to the contractor by CSL will be recovered immediately on consumption either in part or full as the case may be. The same shall be interest free.

36. ESI / EPF remittance details are to be submitted monthly for the processing the bills/claims by the contractor.

37. Quantities specified against each item in the schedule are strictly approximate and tentative and payment will be made as per actual quantity of work done at rates quoted / revised. Operation of individual items specified in the tender schedule will be based on the requirement of CSL during the tenancy of the contract, and contractor will have no claim even if some of the items are not operated at all. The quantity to be executed may also vary according to requirement.

38. Additional items executed based on requirement with the prior approval of Engineer-in-Charge will be operated as extra items.

39. If any difference is found in different parts of the tender documents, the following will be the order of precedence:-

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- (i) Special conditions & Schedule of Completion.
 - (ii) Tender schedule & list of approved makes.
 - (iii) drawings
 - (iv) Specification
 - (v) Pre contract Integrity Pact
 - (vi) General Conditions of Contract and instructions to tenderers.
40. The drawings enclosed with the tender documents are to be returned along with the tender duly signed and the same will form part of agreement.
41. The contractor shall thoroughly study the specifications and drawings and errors/omissions/modifications if any shall be brought to the notice of the Engineer-in-Charge well in advance so that a final decision in the matter could be given in time.
42. Any discrepancy found in the drawings and any variation of quantity available in the schedule with the drawings shall be brought to the notice of the Engineer-in-Charge before the commencement of work.
43. Any shortfalls of drawings / design details etc. shall be informed in writing to CSL within 3 days from the date of award of work.
44. The works shall be carried out complying in all respects with the requirement of relevant bye-laws of the local body under the jurisdiction of which the works is to be executed or as directed by the Engineer-in-Charge and nothing extra will be paid on this account.
45. The contractor shall comply with all legal orders and directions of the local or public authority or corporation and abide by them.
46. The location of the site (G+11) residential employees quarters is at Panampilly Nagar (Varghese Thittayil Road). This may be considered while quoting for the work.
47. The contractor shall employ following technical staff for receiving instructions from department and arranging and executing the work:
- (i) One Project Manager with Degree in Civil Engineering with minimum Eight years experience shall be available with the contractor for this project and shall be available at site / discussions as and when required by the Engineer-in-Charge.
 - (ii) One Graduate Civil Engineer with minimum Five years experience.

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- (iii) Two Graduate Engineers (Civil / Electrical / Safety) with minimum Two year experience OR Two Diploma Engineers (Civil / Electrical / Safety) with minimum three years experience.

48. Recovery will be made from the contractor in the absence of the technical staff at worksite in the following manner-

- (i) Graduate Engineer with at least Five years experience - ₹25,000/- p.m
- (ii) Graduate Engineer or Diploma Engineers as per clause 47 (iii) - ₹15,000/- p.m

The technical staff shall be present for minimum 25 days in a month to avoid recovery. In case of absence recovery will be based on pro-rata basis in a month. However, in the absence of the above personnel, Engineer-in-charge will be at liberty to stop /terminate contract in short notice. Notwithstanding the above, fulltime supervision to the satisfaction of the Engineer-in-charge should be available for night works as specified by Engineer-in-charge.

49. The contractor or his authorized representative with sufficient experience shall be available at site throughout the period of contract for receiving instructions from department, arranging and executing the work. The Contractor / representative shall report at the office of the Engineer - in- Charge on all working days before 8:30 hrs and receive instruction regarding the works.

50. The normal working time of the CSL is from 8.00 a.m. to 4.20 p.m on all weekdays and Saturdays with half an hour interval from 12.30 noon to 01.00 p.m. All Sundays, second Saturday and fourth Saturday are holidays in addition to CSL declared holidays. The site will be available for work during office hours. However if the Contractor wishes to carry out the work beyond normal working hours or on holidays, they should get approval from the Engineer-in-Charge for the same in order to have effective supervision from Department.

51. All labour, skilled or unskilled shall be provided by the contractor. Settling any dispute with the labour/ subcontractor will be contractor's responsibility. The workers engaged for works should have sufficient knowledge and experience in the respective fields. This shall be proved to the Engineer-in-Charge. Child labour is strictly prohibited for this work.

52. The work shall be open at all times for inspection to the Engineer-in-Charge, his authorized representative or any other third party deputed by the Engineer-in-Charge.

53. Attendance of workmen shall be made by all contractors in their attendance register on a daily basis and the strength of daily workforce should be reported to the concerned executing

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officers by the supervisor in charge of the work or by the contractor on a daily basis before 10.00 AM.

54. The work shall be carried out without damaging any of the existing structures, structures under construction in the locality, existing fixtures, electric fittings, cables, roads, pipelines etc. and with least hindrance to adjoining buildings. Any damages caused in the course of execution including lack of safety shall be got rectified at the risk and cost of the contractor.
55. Waste materials like construction waste, pile chipping waste, excavated earth and spilled over concrete etc. are to be cleared from site on a day-to-day basis. Pile muck has to be disposed outside CSL premises. Each area of working is to be cordoned off with necessary signboards and barriers to ensure safe transportation of men and material in the area as directed by the Engineer-in-Charge.
56. After completion of all the works, the contractor has to clear the waste materials / debris at the site to the vacant premises of Cochin Shipyard at his own cost and the final bill shall be settled only after the site is cleared off all the materials.
57. Protect the flooring and steps of staircases during construction and until the completion of work, finished surface of flooring shall be covered with silpaulin sheets or any other suitable materials.
58. The entire work will be executed under single tender. However, separate work orders will be issued to the contractor by the concerned departments as detailed below:
 - Civil works, interior, plumbing works, fire, STP – Civil
 - Electrical works, solar, CCTV, lift, telephone – U&M
59. Before commencement of the work the contractor shall establish at suitable points (as directed by Engineer in charge) reference benchmarks based on the standard benchmark approved by the Engineer in charge. The construction and maintenance of these benchmarks shall be responsibility of the contractor at his cost and risk. These reference benchmarks established by the contractor shall be got checked and approved by the Engineer in charge at suitable intervals of time.
60. The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions, and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the work any error shall appear or arise in the position,

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level, dimension or alignment of any part of the work, the contractor shall at his cost rectify such errors to the satisfaction of the Engineer in charge. The contractor shall provide all necessary instruments, appliances and labour required for the Engineer in charge for checking, if any, of the setting out. The contractor shall carefully protect and observe all benchmarks, site levels, pegs and other things used in setting out the works.

61. The contractor shall be required to employ an experienced surveyor who shall be responsible for setting out the exact position of piles in accordance with the approved pile layout drawings and for establishing the building layout as per the approved drawings. All the setting-out work shall be carried out using precision survey equipment to ensure accuracy. The contractor shall maintain proper records of all survey data and make them available to the Engineer-in-charge for verification when required.
62. Supplying, unloading and stacking of steel and cement shall be done by the contractor and the unloading charge shall be included in their quoted rates. Contractor should quote all items and they will be responsible for the safety, protection and accounting of all materials brought by them.
63. All materials used for the construction shall be of approved brand as per the accepted brand list in the tender document subjected to the approval of Engineer-in-Charge. In case of non-availability of brands specified in approved list, equivalent brand can be used with prior approval of the Engineer-in-Charge. Contractor shall submit the original / attested copy of purchase bills and test certificates for the materials brought to site. Unless otherwise decided by the Engineer-in-Charge, all materials are to be procured by the contractor. All material brought to site shall be registered at the gate as per procedure / instructions by the Engineer-in-Charge. All Materials taken out from the site shall be registered at the gate as per procedure / instructions by the Engineer-in-Charge.
64. Any cement that the Engineer-in-Charge considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise due to improper transport/ storage/ handling by the contractors shall be rejected. Empty cement bags are to be stacked in bundles and to be cleared from site at contractor's expense as directed by the Engineer-in-Charge.
65. All items required for finishing works (flooring / dadoing / step tiles / granite / false ceiling / painting / doors / windows / ventilator) are to be purchased with the consent of Engineer-in-charge after the finalization of colour and pattern.

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66. All rejected materials shall be removed from site within three days from the date of written order from Engineer-in-Charge.
67. All excavated earth, debris, demolition waste, brick pieces shall be disposed of at the location specified by the Engineer-in-Charge. The same shall be transported to the designated low-lying area at CSL land and ensure levelling is completed on the same day.
68. The contractor shall provide mix designs for M30 & M40 Grade reinforced concrete works separately for pile foundation and remaining reinforced concrete works with water cement ratio and maximum water content as per IS 456 & IS 10262 from CSL approved lab / government lab at his own expense before the commencement of work. Minimum cement content for concrete used for piling should not be less than 400 kg/m³ and 380 kg/m³ for remaining RCC work. Any change in the materials which will affect the design mix, separate mix design shall be brought by the contractor prior to the concreting and get approved by the Engineer-in-Charge within the time allowed. The design mix shall be conducted in a recognized laboratory. Design mix submitted by the contractor shall be permitted to use only after successful testing of trial mix taken at site or at approved RMC plant.
69. Contractor shall use mechanized system for the production, transportation and placement of concrete. The contractor shall install sufficient capacity batching plant at approved location at site. Batching of materials in the batching plant shall be permitted only through weigh batching. Batching plant, concrete pump, tower crane, lift and machineries for the execution of work shall be arranged based on site requirements at contractors costs.
70. Ready mix concrete from outside source shall be allowed subject to the conditions that: (i) written permission shall be obtained from the Engineer-in-Charge, (ii) all quality control measures as stipulated by the Engineer-in-Charge are strictly adhered to by the contractor at his cost, (iii) all design mix calculations shall be submitted by the contractor for approval of the Engineer-in-Charge & approval obtained.
71. The contractor shall set up a laboratory at his own expense which shall have facilities for conducting all necessary field test on materials and laboratory test on concrete. The laboratory shall be staffed with qualified and experienced Engineers and technicians. The list of equipments required for site laboratory is as per the Annexure-21. The expenses for sampling and testing of the materials supplied by the contractor in approved laboratory shall be borne by the contractor.

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72. The minimum cement content required for the items used for this work is as follows:

(i)	M30 RCC for pile	: 400 Kg/m ³
(ii)	M40 RCC for column and sheer wall (Ground to Floor Two Level)	: 400 Kg/m ³
(iii)	M30 RCC for column, sheer wall (Above Floor Two Level)	: 380 Kg/m ³
(iv)	M30 RCC for structural members, slab etc.	: 380 Kg/m ³
(v)	RCC 1:1.5:3	: 400 Kg/m ³
(vi)	PCC 1:4:8	: 170 Kg/m ³
(vii)	PCC 1:3:6	: 220 Kg/m ³
(viii)	PCC 1:2:4	: 320 Kg/m ³
(ix)	Block Masonry CM 1:6	: 28.25 Kg/m ³
(x)	Half Block Masonry CM 1:4	: 30 Kg/m ³
(xi)	Brick Work in CM 1:6	: 58 Kg/m ³
(xii)	Plastering CM 1:4, 12mm	: 5.40 Kg/m ²
(xiii)	Plastering CM 1:4, 15mm	: 6.50 Kg/m ²
(xiv)	Plastering CM 1:3, 6mm	: 3.70 Kg/m ²
(xv)	Cement Floating coat	: 2.20 Kg/m ²
(xvi)	Flooring CM 1:4, 20mm	: 12.42 Kg/m ²
(xvii)	Wall cladding CM1:3	: 7.10 Kg/m ²
(xviii)	Pointing Kerb Stone, CM 1:3	: 0.37 Kg/m

73. Holes and chase for water supply, drainage and electrical works etc. shall be provided as directed during the progress of work without any extra claim for cutting and finishing.

74. Any cement slurry added over the base surface (or) for continuing of concreting to obtain better bond between old and new concrete is deemed to have been included in the items and nothing extra shall be payable for extra cement considered in consumption on this account.

75. Electric power supply shall be arranged by the contractor at his own cost. Necessary certification for temporary connection for electricity from KSEB will be done by CSL. However, liaisoning and responsibility of establishing connection rests with the contractor. Payment of electricity charges for the construction during the contract period / extended period has to be bourn by the contractor.

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76. Fresh Water required for the work shall be arranged by the contractor at his own cost. Contractor shall also make his own arrangements to convey water to the actual locations of work. CSL shall on no account be responsible for the expense incurred by the contractor for fresh water obtained from elsewhere. Due to the conditions prevailing in Kerala state or due to other reasons beyond its control the contractor is advised to make suitable arrangements to store water in advance for at least two days work.
77. The contractor has to carry out testing of water sample on monthly basis and report to be submitted to the Engineer-in-Charge. In case the testing is arranged by CSL the charges will be recovered from the respective bills.
78. The contractor shall not construct any structure, even of temporary nature, for any purpose at site, except with the written permission of the Engineer-in-Charge of the work and any construction so put up shall be removed by the contractor whenever the Engineer-in-Charge calls upon the contractor to do so.
79. Construction of temporary toilets, sewage disposal facility, drinking water facility, temporary shelter of workers for having food, rest place, first aid, facility for kids, emergency vehicle service etc shall be made as per labour laws. Nothing extra shall be paid on this account. Workmen are not permitted to stay inside the worksite. However, security personnel / workmen on duty will be allowed during night hours.
80. All Safety measures prescribed in the CSL safety manual shall be strictly adhered during execution of work. Copy of the same is available in the Office of DGM (CE) and the same may be referred before quoting the rates. The safety compliance requirements and entry exit requirements in CSL is placed at Annexure-9. It is the responsibility of the contractor to follow all safety, security and labour rules enforced in CSL during the currency of contract and any violation of the same during the course of work will be at the risk and cost of the contractor and will attract penal action. Action for debarring the contractor also will be taken as decided by the safety department of CSL in case of repeated violation. Contractor shall provide necessary sign boards / signages as per these rules and necessary "Work in progress" boards at his own cost.
81. If scaffolding is required for the works above ground level, the rate for those items should include charges for providing, hoisting, fixing and removing the scaffolding to the required height. Nothing extra will be paid on this account.

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82. The contractor shall provide safe access to work locations. The contractor shall provide the required PPEs to the workmen and should ensure that the workmen are wearing the same at worksite. Accidents if any occur due to the non - use of PPEs is at contractor's risk. For works at height above 9.50m from the Ground level, the contractor shall provide safety net where employees are exposed and it shall extend 2.40m from the edge of the work surface. Nothing extra will be paid on this account. Any accident caused due to safety violation and any damage to the company property suitable penalty will be imposed by CSL including termination of contract if required.
83. The contractor shall report to the Engineer-in-charge details of any accidents as soon as possible after its occurrence. In the case of any fatal or serious accidents, the contractor shall in addition, notify the local Police authorities immediately by available means.
84. The contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the works. Provided that, in respect of any persons employed by any sub-contractor, the contractor's obligations to insure as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that CSL is indemnified under the policy, but the contractor shall require such sub-contractor to produce before CSL, such policy of insurance and the receipt for the payment of current premium.
85. The contractor has to provide the following insurance policies for their workmen/supervisor engaged at site if exemption is claimed for ESI.
 - a) A valid Workmen Compensation policy covering all the workers to be engaged for the work.
 - b) A sum insured of ₹7.50 Lakhs towards any unfortunate death on account of any work site related accident during employment at CSL for all workers engaged at site.
86. If the work is to be carried out in night, necessary permission of the Engineer-in-Charge shall be obtained. Contractor will make his own arrangement for lighting the area and no extra amount will be paid on this account.
87. Extra / substitute items, if any, ordered shall be paid at market rates of the contract. For this purpose, the contractor shall produce the GST invoice, and base rate shall only be considered for rate analysis, which will be checked and verified by the Engineer-in- Charge / authorized representative to ascertain the correctness. Market Rate shall be the rate as decided by the

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Engineer-in-Charge on the basis of the prevailing cost of materials, labour at the site where the work is to be executed, over heads and profit at 10%. The maximum payable rates shall be limited to the market rates.

88. Rewards and Reprimand policy (R&R Policy) of CSL shall be binding for this contract. The contractor shall go through the R&R policy and shall have full knowledge of the same while carrying out the work. The R&R policy can be accessed through the CSL website at the following link <https://cochinshipyard.in/uploads/FTPStaging/HOMEQHSE/RewardsReprimandPolicy.pdf>.

89. Force Majeure Event

In the event of circumstance or a combination of events and circumstances which are referred below and which are beyond the reasonable control of the contractor and / or employer as the case may be or which could not have been prevented by the exercise of reasonable skill and care, and which or the consequences of which materially affect the execution of the work, or the contractor's obligations under this Contract in whole or in part then and in that event the contractor shall be, subject to the provisions of this contract, entitled to claim proportionate extension of the contract period.

(i) Force majeure including but not limited to:

- (a) War, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (b) Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war,
- (c) Riot, commotion, disorder, strike or lockout by persons other than the contractor's personnel and other employees of the contractor and subcontractors,
- (d) Munitions of war, explosive materials, ionizing radiation or contamination by radio activity, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio-activity, and
- (e) Natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

(ii) Storm, to the extent that it could not reasonably have been expected to occur at the place, at the time of year, in question;

(iii) Epidemic, famine;

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- (iv) Strikes or boycotts interrupting supplies and services to the site (excluding strikes or boycotts by employees, agents or representatives of contractor, or its subcontractors for any reason whatsoever);
- (v) Fire caused otherwise than by any act or omission on the part of the contractor or its agents servants or employees or its subcontractor;
- (vi) Any event or circumstance of nature analogues to any of the above or an Act of God.

Obligation of the Parties to perform

The obligations and liabilities of the contractor under this Contract would continue as long as the performance is not impeded by Force Majeure Event as defined above. The contractor shall resume performance of its obligations under this Contract as soon as possible after the Force Majeure Event no longer exists. Provided that the performance of the contractor's obligations and liabilities shall, for the period of Force Majeure, be governed as per and be subject to the provisions of this clause.

Notice

The contractor if affected by the Force Majeure Event shall give notice to the employer in writing of the occurrence of any of the Force Majeure Event as soon as the same arises, and in any event within three (3) days after the knowledge by the contractor.

Notice shall inter-alia include full particulars of –

- i) the nature of each Force Majeure Event
- ii) the date and time effective when the performance of contractor's obligations under the contract was affected by the Force Majeure Event;
- iii) the effect which such Force Majeure Event is having on the performance of contractor's obligations under the Contract was affected by the Force Majeure Event;
- iv) the measures which the contractor has taken, or proposes to take, to alleviate the impact of those Force Majeure Events or mitigate the damage; and
- v) any other relevant information.

Reporting requirement

For so long as the contractor continues to be affected by the Force Majeure Event it shall provide Engineer with regular (and not less than weekly) written report containing

- i) the information called for under and
- ii) such other information as the other party may reasonably request.

Costs, Revised Timetable

During the period of Force Majeure

- (i) The employer shall not be responsible for any cost resulting from a Force Majeure Event.

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- (ii) Any time period specified in this Contract for the performance of an obligation by the contractor may be extended proportionately by employer for such a period during which the Force Majeure Event affected the obligation of the contractor.

Period of Force Majeure

In this clause reference to a period of Force Majeure shall mean the period of commencing from the date and time specified in the notice given by the contractor, until the earlier of –

- i) Such time as the performance by the contractor of its obligations is no longer, materially and adversely affected; and
- ii) If this Contract is terminated pursuant to clause, the date of service of such notice.

Termination due to Force Majeure Event

In the event that such Force Majeure Event shall physically impede or prevent the contractor from performing its obligations under this Contract for more than 30 days from the date of commencement of such force majeure event, the contractor and the employer may mutually decide the terms upon which the contractor shall continue the performance of its obligations or to terminate this Contract. The employer shall if it is so agreed between the parties terminate the Contract.

Consultation and Duty to Mitigate

For so long as the period of Force Majeure is continuing, the contractor and the employer shall consult each other and the contractor shall use all reasonable endeavours to alleviate its effects on the performance of its obligations under this Contract. The employer shall afford reasonable assistance to the contractor to alleviate the effect of the Force Majeure Event on the performance by contractor of its obligations under this Contract.

Termination due to Force Majeure

If the Contract is terminated by the employer or the contractor under provisions of this clause due to a Force Majeure event, the amount of compensation shall be as mutually decided between the parties at the appropriate time and as per the terms and conditions mutually agreed upon and subject to, the provisions of this Contract.

90. If the contractor suffers delay in due execution of the contractual obligation due to delays caused by force majeure as defined above, the agreed time of completion of the job covered by this contract or the obligations of the contractor shall be extended by a period of time equal to period of delay, provided that on the occurrence of any such contingency, the

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contractor immediately should report in writing to CSL. A hindrance register shall be maintained by CSL in which the hindrances due to force majeure and hindrances attributable to CSL shall be recorded and signed by both parties. The hindrance so recorded will be regularized in accordance with the Contract provisions. The contractor shall resume performance of its obligations under this Contract as soon as possible after the Force Majeure Event no longer exists. During the period of Force Majeure CSL shall not be responsible for any cost resulting from a Force Majeure Event.

91. To ensure good progress of the work during execution, the contractor shall be bound, to complete the work as per the physical milestones given in Annexure-2.
92. If any ambiguity arises as to meaning and intent of any of portion of the specifications and drawings or as to execution or quality of any work or material or as to measurement of the works the decision of the Engineer-in-charge shall be final and binding on the contractor.
93. PRICE ADJUSTMENT PAYMENT FOR TOR STEEL:

For steel price adjustment, variation in all India wholesale index up to $\pm 5\%$ will not be considered for payment / recovery. This variation shall be accounted in the contractors quote. Any variation beyond $\pm 5\%$ will be considered for reimbursement / recovery.

The variation in prices shall be applicable only for the work done up to the date of completion as specified in the contract. Escalation during the extended period if granted for the reasons attributable to the contractor shall not be payable.

Price Adjustment on account of increase or decrease (beyond $\pm 5\%$) in the cost of Tor steel procured by the contractor shall be paid or recovered in accordance with the following formula.

$$V_s = 0.85 \times R \times \frac{(S_i - S_o)}{S_o}$$

Where V_s = Increase or decrease in the cost of work during the month under the consideration due to change in the rates for steel.

S_o = All India wholesale index for steel as published by the Economic Advisor to Govt. of India, Ministry of Industry & Commerce in the previous month prior to the closing date of submission of bids.

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S_i = All India wholesale price index for steel as published by the Economic Adviser to Govt. of India, Ministry of Industry & Commerce in the previous month prior to the last day of the period to which a particular interim payment certificate is related.

R = Value of tor steel supplied as per Item No. 76 of tender schedule during the period for which escalation is under consideration.

No other escalation whatsoever, except as stated above shall be paid. Any deviation to this clause shall render the offer liable for rejection.

The following principles shall be followed while working out increase/decrease due to variation in prices of tor steel.

- (i) The increase/decrease due to variation shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the three calendar months of the said work. The first such payment /recovery shall be made at the end of 3 months, after the month (including) in which the work commenced and thereafter at 3 months intervals. At the times of completion of work, the last period for payment might become less than 3 months depending on the date of completion specified in the contract.
- (ii) The indices (S_i) relevant to any quarter for such increase/decrease is paid or recovered shall be the arithmetical average of the indices relevant to the 3 calendar months. If the period up to the date of completion specified in the contract after the quarter covered by the last such installment or payment is less than 3 months for indices (S_i) shall be the average of indices for the month falling within that period.
- (iii) Ten percent of the escalation payment shall be retained from each escalation bill and this shall be released after completion of the work.
- (iii) Every quarter from the date of award of the contract, the contractor shall submit to the DGM(CE) a written statement accompanied by authentic documentary evidences of the changes, if any, that have occurred in the specified indices of materials to substantiate the claim for variation in prices.

94. Occupational Health, Safety & Environmental requirements.

- a) The contractor is deemed to comply with the Occupational health, safety and environmental policy of the company and also to all operational controls/standard

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operating procedures and shall undertake the work in total compliance with the requirements of the established Integrated Management System (IMS) of the company.

- b) The Contractor shall undertake the work in total compliance with all applicable legal/statutory requirements related to occupational health, safety and environment effective in the state of Kerala.
 - c) It is the sole responsibility of the contractor to assure that he or his representatives shall perform works in company lands/facilities/worksites following all requirements related to the Integrated Management System of the company and the health/safety/Environmental Rules effective in the state.
 - d) If any contractor failed to comply with or violated any clauses/requirements of occupational health, safety and Environmental Rules effective in the state, in their activities or at work sites and the same shall be exposed to the government or any competent authorities upon inspections, the contractor shall be solely responsible for all liabilities caused by his/her action and shall be responsible for paying the penalty and taking stipulated corrective actions insisted by the authorities within the specified time, at their own cost. Any liability to the company in this regard needs to be compensated by the contractor.
 - e) Upon completion of the work, contractor shall clear the area and shall not leave any Occupational health/safety/environmental liabilities to the company, from their activities at the worksites.
95. The contract involves an obligation of secrecy and the contractor, his agents, servants or subcontractor or their agents or servants shall observe and comply with the requirements of the Indian Official Secrets Act 1923, and the rules there under or any statutory modifications or re-enactments thereof. Any breach of this clause shall constitute a breach of the contract. The contractor shall not disclose to anybody the details of drawings prepared for the work without the approval of CSL. No photographs of the CSL area shall be taken or permitted by the contractor to be taken by any of his employees without the approval of the competent authority and no such photographs shall be published, or otherwise circulated without the the approval of CSL.

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96. Any dispute(s) or differences arising out of or in connection with the Contract shall, to the extent possible, be settled amicably between CSL and the contractor. Any litigation in connection with contract shall be subjected to the exclusive jurisdiction of the Courts at Kochi, India.
97. Engineer-in-charge will be at full liberty to impose penalties for the violation of any of the agreement clauses.
98. Any clarifications regarding the tender can be obtained from the office of DGM (CE) or at Mobile No.: 9995806170 or Phone: 0484 – 2501459.

Sd/-

Deputy General Manager (Civil)

Signature, Name &

Address of Contractor:

Date

TECHNICAL SPECIFICATIONS

File No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS/2026/2

CONSTRUCTION OF MULTI-STOREY (G+11) EMPLOYEES RESIDENTIAL QUARTERS AT CHERIYAKADAVANTHRA

I. CIVIL WORKS

A. EARTHWORK

1. Excavation:

The work to be done under this section comprise performance of all work necessary for excavation with shoring, strutting, dewatering, pumping including disposing of all surplus excavated material from the site as directed by the Engineer-in-Charge.

Excavation shall be carried out in any type of soil, gravel, conglomerate etc. encountered within width, length and depths indicated in the drawings. Where any

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temporary or permanent structure is available all precaution shall be taken during excavation and or any construction operation shall be exercised not to damage such existing temporary or permanent work.

Any obstacles encountered during excavation shall be reported immediately to the Engineer-in-Charge and shall be dealt with as directed by the Engineer-in-Charge.

2. Support of Excavation:

The Contractor shall adequately support the sides of excavation as may be necessary to prevent subsidence or movement of the material in which the excavation is being carried out and to ensure the safety of persons and nearby structures. Areas to be cordoned using warning tapes, warning boards, barricading etc.

3. Dewatering:

While execution of works, if so encountered, the Contractor shall provide for the purpose of excavation under water all the necessary dewatering equipment like well points, pumps (including stand byes), pipes, conduits, etc. and make necessary arrangement for proper drainage of the pumped water from the well points and its easy disposal without affecting the site and the adjoining areas.

4. Earthwork in Filling and Site Clearing:

Filling is to be carried out up to the level as shown in the drawing or as instructed by the Engineer-in-Charge. Any boulders, debris etc. encountered during filling shall be removed as directed by the Engineer-in-Charge.

5. Filling Layer:

Compaction has to be carried out after filling in layers, watering etc. After the compaction of each layer, the next layer of filling shall not be permitted to be deposited until the Engineer-in-Charge is satisfied that the previous layer has achieved required compaction.

6. Setting Out and Making Profiles:

Temporary benchmark shall be provided for the execution of the work free of cost. The initial ground levels shall be recorded. The surveyor, labour, total station & dumpy / tilting levels with staff required for taking levels shall be supplied by the contractor at no additional cost.

7. Earth Work in Filling / Refilling:

Unless otherwise specified, selected excavated earth shall be used for refilling. For general area filling for raising formation level selected earth shall be used as directed by the Engineer-in-Charge. All clods of earth shall be broken or removed. However the decision /instructions of the Engineer-in-Charge shall be final.

B. PILING

1. Scope:

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Applicable to all piling operations (tractor mounted rotary rig with DMC method) and foundations (deep and shallow foundation) for buildings, sewage treatment plant, underground sump etc.

2. Procedure:

- 1) Establish benchmarks, cut-off levels, and reference grids prior to setting out pile locations.
- 2) Provide proper roads / assess for the movement of rigs, trucks and slurry tankers.
- 3) Ensure proper power supply, water, bentonite storage facility etc.
- 4) Ensure that the piling area is properly barricaded with signage. Ensure the moving parts of the rigs are provided with proper cage.
- 5) Ensure that proper PPE's like helmet, gloves, boots, reflective vest are used to ensure safety.
- 6) Ensure shutdown of all equipment in case of emergency. First aid and fire extinguisher shall be ensured nearby.
- 7) Only authorized and trained personnel shall handle slurry chemicals, operate rigs, or work near boreholes/slurry pits.
- 8) Ensure experienced operators and supervisors are deployed for piling work.
- 9) Site engineer to ensure that the pile locations are marked as per approved drawings using total station or GPS and maintain grid accuracy.
- 10) Rig movement schedule to be prepared prior to commencement of work. Safety protocols to be followed.
- 11) Site engineer to ensure that the soil investigation reports and bore log data is available and reviewed at site.
- 12) Position rotary rig at pile point, check verticality using spirit level or plumb line. In case of DMC assemble tripod, winch, drill pipe etc and install mud circulation system. Ensure the erected rigs for DMC piling are properly secured at ground by driving pegs and tying properly.
- 13) Install temporary/permanent casing if required, especially in loose soil strata or for shallow water tables. Follow IS 2911 (Part 1/Sec 4) for casing requirements.
- 14) Drill to the desired depth, use bentonite / polymer slurry for stability while drilling, and monitor verticality and depth regularly, monitor bentonite / slurry properties (SG, viscosity, pH) maintain circulation and slurry level at all times.
- 15) Remove the loose materials / cuttings using regular flushing and ensure borehole is stable and clean before concreting.
- 16) Bentonite suspension used for piling work shall satisfy the requirements as specified in IS: 2911 (Part-1/Sec4): 2010.
- 17) Flushing of pile should continue till coarse materials ceases to come out with the overflowing fluid. The density of bentonite to be brought down to 1.12g/ml by flushing before concreting.
- 18) Socketing of pile shall be as per the geotechnical recommendations and verification of SPT.
- 19) Ensure that the slurry is disposed from site as per environment and legal considerations. The rate of disposal of bore muck is to be included in the item of piling.

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- 20) Chisel / bore diameter shall conform to tolerances specified in IS 14593 (should not be less than the diameter of pile by more than 75 mm).
- 21) Ensure that the reinforcement cage is fabricated as per the approved drawing. Lower the cage centrally using guides / spacers.
- 22) Lap length, welding, spacing etc. shall conform to IS 456 and IS 2911. Spiral reinforcement is to be welded at alternate locations to main reinforcement bars or as per approved design. Stiffener rings shall be provided at every 1.5m centre to centre or as per approved drawing and to be welded on the main bars for providing rigidity to reinforcement cage. Spacers to be provided for maintaining cover.
- 23) Concrete grade (M30) and cement content (400kg / cum) shall be as per IS 2911 (Part 1/ Sec 2).
- 24) Use tremie method for concrete placement. Tremie pipe shall be min: 150mm dia. Tremie pipe shall always be embedded in concrete while concrete placement.
- 25) Ensure slump of concrete 150–180 mm, concreting to be continuous and uninterrupted. Ensure standby concrete mixers or alternate source of concrete for continuous pouring of concrete till completion.
- 26) Check for actual concrete consumption matching with theoretical quantity.
- 27) Maintain concrete level up to pre-determined cut off level / above ground water table. Overflow minimum 1 m above cut-off level to ensure top-quality concrete.
- 28) Chipping of pile head to be done carefully without damaging the cage. Pile head to be exposed up to cutoff level as per approved drawing. The cutoff level shall be Min. 75mm inside the pile cap.
- 29) Adjacent piles to be cast at intervals as per code and design recommendations.
- 30) Maintain records / bore log for each pile (pile ID, depth, dia, date, concrete qty, etc.).
- 31) Ensure quality control checks for bore depth, bore diameter, slurry properties, concrete strength, concrete slump, reinforcement cage, verticality, integrity tests, eccentricity etc.
- 32) The mapping of piles to the prepared for checking eccentricity and for any further design recommendations.
- 33) Pile integrity test as per IS 14893:200.
- 34) Pile load tests initial and routine tests as per IS 2911 (Part 4).
- 35) In case of rejected / failed piles recommendation from designer to be obtained prior to proceeding further.
- 36) Pile length for payment to be measured from cut-off level to the tip of the pile or as per contract condition. Depth to be measurement by sounding and verified from concreting record / bore log data.

C. CONCRETE WORK

1. General:

This section covers the requirements for cement concrete including materials proportioning, batching, mixing, testing, placing, compacting, finishing, jointing, curing and all other work as required for cast-in-place plain and reinforced concrete. Cement concrete shall be composed of cement, fine aggregate, coarse aggregate, water, with or without admixture as approved, proportioned and mixed as specified herein.

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2. Mix design:

The contractor shall provide the mix design for grades specified prior to the concreting and get approved by the Engineer-in-Charge within the time allowed. The mix design shall be conducted in a recognized laboratory. Mix design submitted by the contractor shall be permitted to use only after successful testing of trial mix taken at site or at approved RMC plant.

3. Certificates:

With each mix design, the Contractor shall submit laboratory test reports on concrete cubes and as well as on ingredients to be used at the actual construction work for approval of the Engineer-in-Charge.

4. Materials:

Before bringing to the site, all materials for cement concrete shall be got approved by the Engineer-in-Charge. The materials brought on to the works shall conform in every respect to their approved samples. The Engineer-in-Charge shall have the option to have any of the materials tested to find whether they are in accordance with specifications. Any materials which have not been found to conform to the specifications and not approved by the Engineer-in-Charge shall be removed from the site by the contractor within the time stipulated by the Engineer-in-Charge.

5. Cement:

- i) The cement used shall be OPC 45/53 grade confirming to I.S. 8112 / IS:12269 or PPC confirming to IS: 1489.
- ii) The cement shall be supplied in bags for the purpose of supply. Packed cement shall be delivered to the site in original sealed bags which shall be labelled with the weight, date of manufacture, name of manufacturer, brand and type. In case of RMC the batch and test report of cement to be submitted.
- iii) All cement shall be fresh when delivered and at ambient atmospheric temperature.

6. Aggregates:

- i) Fine Aggregates: The fine aggregate shall be, M-sand or other approved sand conforming to IS:383. It shall be free from clay, loam, earth or vegetable matter and from salt or other harmful chemical impurities.
- ii) Coarse Aggregates: The coarse aggregate shall be crushed stone conforming to IS: 383, having nominal size of 20 - 12 mm / graded aggregates as per requirements and as approved by Engineer-in-charge.

7. Water

Water used in the works shall be potable water and free from deleterious materials. Water used for mixing / curing concrete as well as for cooling or washing aggregate shall be fresh and clean, free from injurious amounts of oil, salts, acids, alkali, other chemicals and organic matter. The contractor has to carry out testing of water sample

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on monthly basis and report to be submitted to the Engineer-in-Charge. In case the testing is arranged by CSL the charges will be recovered from the respective bills.

8. Admixtures and Additives:

Chemical admixtures shall be permitted in concrete as per approved mix design.

9. Approval of Design Mixes:

The contractor shall submit to the Engineer-in-Charge for comment sufficient evidence based on trial mixes that for each grade of concrete, the intended workability, the proposed mix proportions and method of manufactures, which will produce concrete of the required quality. The contractors shall obtain from the Engineer-in-Charge, his written approval on the mix design for each grade of concrete before any concrete of that grade is placed in the works.

10. Concrete Production:

For RCC / structural member concrete, weigh batching to be used as per mix design and for PCC / non-structural members weight / volume batching shall be used at the discretion of Engineer-in-Charge. Ready mix concrete will be permitted by CSL with the prior approval of the Engineer-in-Charge.

11. Concrete Mixing:

All concrete in the correct proportion of ingredients in approved mix design, whether ordinary or controlled, shall be mixed in an approved mixer for the minimum time necessary to ensure adequate quality and uniform distribution of the materials. The cement and aggregates shall normally be first mixed dry until all particles of aggregate are coated with cement after which the water shall be added along with admixture. Allowance shall be made for the moisture content of the aggregates when calculating the amount of water to be added for each mix.

12. Transporting:

Concrete shall be handled from the place of mixing to the place of final deposit by methods which prevent segregation, loss of ingredients and contamination and maintain the required workability. All major concreting is advisable to be done by concrete pump of adequate capacity. If concrete pump is used, delivery system with adequate boom length, pipe line and associated items shall be obtained before installation of the concrete pump. There shall also have the provision of standby system in case of any eventualities for transportation and placement of the concrete.

13. Preparation before Concreting:

The inside surface of the forms against which concrete is to be placed shall be clean. The forms shall be wetted before placing concrete. Concrete shall not be placed in the works until the representatives of Engineer-in-Charge has inspected the formwork, reinforcement, inserts and sleeves if any and given permission to place concrete.

14. Placing:

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Concreting of any portion of the works shall be done only in the presence of the Engineer-in-Charge's representative. Concrete shall not be deposited at a faster rate than it can be placed and compacted. As far as possible cold joints in concrete should be avoided.

15. Compaction:

The contractor shall use mechanical vibration for all concrete. Sufficient numbers of spare vibrators of various capacities & types shall be kept readily accessible to the place of deposition of concrete to assure adequate vibration in case of breakdown of those in use. Particular attention shall be given to the compaction of the concrete around the water bars to ensure that no voids or porous areas are left.

16. Finish:

All concrete surfaces shall have a good, dense finish. All concrete surfaces shall be free from honey combing, air holes or other blemishes. The contractor shall be responsible for providing an adequate hacking in concrete where plastering is to be done.

17. Curing and Protection:

Immediately after completion of any surface finishes, the concrete shall be protected from the evaporation of moisture by means of wet hessian or other suitable material kept soaked by spraying. Method of curing and their duration shall be such that the concrete will have satisfactory durability and strength and members will suffer a minimum distortion, be free from excessive efflorescence and will not cause, by its shrinkage, undue cracking in the works.

The top surfaces of slabs and other horizontal surfaces shall be cured by ponding of water in cement mortar bunds. Steeply sloping and vertical formed surfaces shall be kept completely and continuously wet prior to and after the striking of formwork by means of wet hessian or other suitable material kept soaked / spraying.

18. Inserts:

The Contractors shall fix all necessary inserts such as fan hooks, steel plates, pipe sleeves, anchor bolts, puddle flanges etc. before concrete and make provision of holes, pockets, dowels etc.

19. Cracks:

If any cracks develop in the reinforced cement concrete construction which in the opinion of the Engineer-in-Charge may be detrimental to the strength of the construction, the contractor shall test the structural element in question. If under these test loads the cracks shall develop further the contractor shall dismantle the construction, cart away the debris replace the construction and carryout all consequential work thereto.

If the cracks are not detrimental to the stability of the construction in the opinion of the Engineer-in-Charge, the contractor shall grout the cracks with pneumatically applied

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mortar or epoxy grout or by other specified treatment as directed by the Engineer-in-Charge at his own expense and risk.

20. Formwork:

a) General

Formwork shall include all temporary or permanent forms of moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

Formwork shall be of rigid construction true to shape and dimensions. It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces. Screw jacks or hard board wedges, where required shall be provided to make up any settlement in the form work either before or during the placing of concrete. Forms shall be so constructed as to be removable in sections in the designed sequence without damaging the surface of concrete or disturbing other sections.

The completed formwork shall be inspected by the representative of Engineer-in-charge on receipt of information in this regard from the Contractor, before the reinforcement bars are placed in position.

The contractor shall mobilize shuttering materials of slab and beams required for two floors and the same shall be kept at site until the completion of R.C.C. frame structure. Steel shuttering shall be used for formwork to the maximum extent possible.

b) Materials for Formwork:

Formwork surface in contact with concrete (sheathing) shall be of steel or plywood. Hard wood section / steel section shall be used for the framework of shuttering. Sheathing for the form work of column shall be of steel / plywood with approved thickness. The formwork used for concreting shall be water tight, approved joint fillers shall be used at all joints.

c) Propping and Centering:

Props used for centering shall be of adjustable steel props without any deformation, damage etc. Bracing of props should be done as per the satisfaction of Engineer-in-Charge.

d) Removal of Formwork:

The formwork shall be so removed as not to cause any damage to concrete due to shock or vibration. In a slab and beam construction, sides of beam shall be stripped first, then the under sides of slab and lastly the underside of the beam.

e) Minimum stripping time of Formwork:

- RCC Columns, sheer wall & Vertical sides - 24 to 48 hours or as may be decided by the Engineer-in-Charge.
- Slab spanning up to 4.5M – 7 Days

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- Slab spanning over 4.5M – 14 Days
- Beams spanning up to 6.0M- 14 Days
- Beams spanning over 6.0M- 21 Days

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

21. Reinforcement:

c) General

TMT reinforcement steel shall be used as per design and conforming to IS: 1786 pertaining to Fe 500D grade of steel or above. TMT reinforcement steel as per list of acceptable makes, shall be allowed in the work. Contractor shall produce manufacturer test report for each dia. The reinforcement steel shall conform to standard and quality in accordance with relevant I.S codes as specified. All reinforcement shall be clean and free from loose mill scales, dust, loose rust, coats of paints, oil or other coatings which may destroy or reduce bond.

The laps and splices of reinforcement steel shall be as per drawing or IS:456 provisions. Minimum cover to be maintained using approved spacers:

- a) Slab: 20 mm
- b) Beams: 25 mm
- c) Columns: 40 mm
- d) Footings: 50 mm

d) Bending Schedules:

Contractor shall make arrangements for preparing bar bending detail based on structural drawings given along with the tender.

e) Storage of Steel Reinforcement:

The reinforcement steel shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Steel reinforcement, shall be stored clear of the ground. Usage of steel for the work shall be first come first use basis or as directed by Engineer-in-Charge.

f) Approval of Reinforcement:

The Contractor must obtain the approval of the Engineer-in-Charge to the reinforcement fixed in position, before concrete.

D. CEMENT CONCRETE SOLID BLOCK

i) Block Works- General

Solid concrete blocks shall generally conform to IS:2185 and the minimum average compressive strength shall be 4N/mm². Blocks shall be regular in size and shape. The blocks shall be tested for crushing strength before using for works. The height of laying

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masonry may be up to a height of 1000 mm per day or as approved by the Engineer-in-Charge.

The block work shall be in plumb, square and properly bonded. For setting out of rooms/corridors/walls a layer of block work shall be laid and after the checking of right angles, lines, levels and satisfaction of Engineer-in-Charge, the balance shall be constructed as per the drawings. Blocks shall be so laid that all joints are well filled with mortar. The face of blocks work shall be kept clean at all times. The cement mortar used for block work shall be as per the specification. M-sand or approved sand clean and free from dirt clay, organic matter or other impurities shall be used. The block work shall be cured for strength and durability.

E. PLASTERING

1. Mortar:

The mortar used for plastering shall be as per the specification. Cement and sand shall be tested as specified in the section on concrete. Mixing of mortar shall be mechanical / manual means. Mortar shall be used within 30 minutes of addition of water. Mortar which has partially set shall not be used and removed from the site immediately. Wherever hand mixing is being done, is to be carried out in M.S/ G.I sheets or in clean surface. Wherever specified, water proofing compound of approved make shall be added to the mortar and mixed strictly in accordance with manufacturer's instructions.

2. Scaffolding:

Generally scaffolding shall be as mentioned for masonry work. Stage scaffolding shall be provided for plastering work as per standard practice and as directed by the Engineer-in-Charge. This shall be independent of the walls.

3. Preparation of Surface:

Joints of Block work shall be raked-out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scraping. Shuttering imperfections of all concrete shall be removed by hacking with chisel and all resulting dust and loose particles cleaned and the surface shall be thoroughly hacked or bush hammered. The surface shall be kept wet before plastering is commenced. Approval shall be taken from the Engineer-in-Charge before commencing each plastering work. As far as possible conduit works shall be completed prior to plastering.

4. Internal / External Plaster:

The internal and external plaster shall be single coat of ordinary cement and medium coarse sand mixed in specified proportion. The internal plaster where specified or shown shall be 12mm and external plaster shall be 15mm thick. Special care shall be taken to secure bond with the concrete / solid block masonry. Before plastering, thickness modem shall be done in order to get the plumb / linear measurements. The internal / external plastering shall be finished with wooden float to give the best smooth surface. The finishing of external plastering shall be as per the specification. Where

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ever the block work and R.C.C column / beam meets, joints shall be fixed with fiber mesh before plastering.

5. Ceiling Plaster:

Ceiling Plaster where specified or shown shall be 6 mm thick in 1:3 cement sand mortar (1 cement:3 fine sand) and shall be finished to smooth surface. Before plastering, the ceiling shall be hacked by hammer to get the necessary grip for the plastering.

F. FLOORING / GRANITE WORK / INTERLOCK PAVER

1. General

This section covers all flooring and wall tiling works. No work under this section shall be started until specifically allowed by the Engineer-in-Charge. The samples of flooring / dadoing materials shall be got approved by the Engineer-in-Charge sufficiently prior to ordering. The works shall be got done by skilled and specialized workmen experienced in the respective trade of work.

2. Vitrified Floor Tiles

Vitrified floor tiles shall be of approved quality and make conforming to relevant IS stipulations. They shall be flat, true to shape and free from cracks, crazing spots, chipped edges and corners. These shall be of specified size, type and colour and laid to pattern as shown in the drawings or as approved by the Engineer-in-Charge. The floor tiles shall be laid using cement motor as specified in the specification. Slope in floors shall be provided as per architectural drawings or as instructed by the Engineer-in-charge.

Care shall be taken to see that full tiles are used as far as possible. Where not possible, the edge tiles shall be neatly cut with a tile cutter to required size and the edges rubbed smooth to ensure straight and true joints. The cut edge of the tiles shall not be installed in exposed locations. In the staircase steps, tile edges/nosing to be chamfered to the satisfaction of Engineer-in-Charge without any extra cost.

After laying is complete, the joints shall be cleaned off the grey cement grout with wire brush and all dust and loose mortar removed. The joints shall be grouting with epoxy grout mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardener and 0.20 kg of resin per kg) and matching pigments.

3. Vitrified wall Tile in Dado:

Vitrified tiles for dado shall be of approved quality and make conforming to relevant IS stipulations. They shall be flat, true to shape and free from cracks, crazing spots, chipped edges and corners. These shall be of specified size, type and colour and laid to pattern as shown in the drawings or as approved by the Engineer-in-Charge. The dadoing shall be fixed using cement adhesive as specified in the specification.

4. Laying of Tiles:

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The tiles used for laying shall be adequately clean, sorted out and a coat of neat tile cement mortar / adhesive applied at the back of tiles and set in the bedding mortar. The tiles shall be tamped and corrected to proper plane and lines. The tiles shall be set in the required pattern and joining with spacer 3mm width. The joints shall be as fine as possible and uniform. Top of skirting or dado shall be truly horizontal and joints truly vertical except where otherwise indicated. Where full size tiles cannot be fixed these shall be cut to the required size and their edges rubbed smooth. Care shall be taken to ensure that as far as possible cut tiles are used in non-exposed locations.

5. Granite Counter Top:

Granite shall be hard, sound, dense and homogeneous in texture in accordance to the sample & of the required size and thickness approved by the Engineer-in-charge. It shall be reasonably uniform in colour, texture, pattern & shape and free from stains, cracks, decay and weathering and of specified quality, size and thickness. The slabs shall be pre-polished or matte flamed finished in the factory before delivery. Before placing order a sample shall be produced at the site and got approved. Exposed edges to be half/full rounded as per the satisfaction of Engineer-in-Charge. Provision of holes for entry of gas hose / sink / pipes etc. if required to be done without any extra cost. Joints shall then be grouted with white cement mixed with or without pigment to match the shade of the topping layer of the slab.

6. Inter locking block paving works:

The interlocking paver blocks shall be of approved quality, make and pattern. The thickness of the blocks shall be as specified in the tender schedule. The compressive strength of the interlocking paver block shall be as specified in the tender schedule. The interlocking paver blocks shall be laid on top of the prepared base using 6mm stone aggregate to the required thickness as per the specifications in required pattern. On completion of the laying work, approved fine screened sand / M sand shall be spread over the paving and the joints filled with sand and compacted as directed by the Engineer-in-Charge. Compaction with a power vibrating plate shall be used suitably as recommended by the approved manufacturer. Any blocks damaged during laying shall be replaced.

G. PAINTING

1. General:

Work of painting shall be one of the last items of work and shall not be taken up until all other internal works except fittings & fixtures have been completed and approved. No work under this section shall start without approval from Engineer-in-Charge.

2. Materials:

All materials shall be the best of their kind and of approved manufacture for each item.

3. Storage:

All materials shall be stored in a neat and orderly fashion in one single clean space.

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Care shall be taken to maintain this place as clean and dust- free as possible. Contractor shall provide paints in their original containers in sealed condition. The contractor shall produce invoices, of relevant painting materials before use.

4. Specialized Workmen:

All work shall be done by the Contractor through specialized skilled workmen experienced in the trade.

5. Preparation:

The plastered surfaces shall be allowed to dry out completely. All surfaces to be finished shall be thoroughly brushed and cleaned of mortar drops, dust, dirt, fungi, rust, mill-scale, efflorescence and all other extraneous material. All loose pieces and scales shall be removed by scrapping. If the painting starts after floor tile works, contractor should provide polyfoam /plastic sheet / silpaulin sheet over floor to protect the surface of tiles.

6. Finished Surface:

All finished surface shall be smooth and of even shade to the satisfaction of Engineer-in-Charge.

7. Damages to be made good:

Any damage or disfigurement of other works caused by the painting works shall be immediately made good. All paint spots and other stains shall be thoroughly and carefully removed from all floors, doors, windows, fittings, furniture, glass, hardware and all other surfaces required, by paint removers and the places left clean and tidy.

H. SANITARY FIXTURES

1. General

All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specially mentioned or not in the schedule of quantities, specification, drawing accessories shall include proper fixing arrangement, brackets, nut, bolts, screws and required connection pieces.

2. Water closet:

It shall consist of white vitreous single piece, floor mounted water closet of approved brand / make, shape, size, pattern with integrated white vitreous flushing cistern of capacity 10 ltr. with dual flushing system, including all fitting and fixtures with white solid plastic soft close seat cover and lid, cistern fittings, nuts, bolts and gasket etc. including making connection with P/S trap, complete in all respect as per direction of the Engineer-in-Charge. The base rate will be as per the specification. Adjustment will be made for the variation in price from the base rate.

3. Wash Basins.

Wash basins shall be of white vitreous flat back / counter top type of size as per specifications. Wash basins shall be of one piece construction, including a combined

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overflow. Basins shall be provided with single or double tap holes as specified. The tap holes shall be 28 mm square or 30 mm round or 25 mm round for pop up hole. Each basin shall have circular waste hole to which the interior of basin shall drain. Each basin shall be provided with fittings as specified in the schedule. The base rate will be as per the specification. Adjustment will be made for the variation in price from the base rate.

4. Pillar Taps:

Pillar taps shall be chromium plated brass and shall conform to IS 1795. The nominal sizes of the pillar tap shall be 15 mm or 20 mm as specified. The nominal size shall be designated by the nominal bore of the pipe outlet to which the tap is to be fitted.

5. Kitchen Sink:

Kitchen sink shall be of Stainless steel 304 kitchen sink conforming to IS 13983(1994) of size, pattern and thickness as per schedule with stainless steel waste coupling & plug 40mm with necessary fitting.

6. Towel Rail:

The towel rail shall be of CP Brass as specified and as per direction of Engineer-in-charge. It shall be fixed in position by means of C.P. brass screws and rawl plugs embedded in the wall.

7. Health Faucet:

The health faucet shall be of CP brass as specified and the pipe should be ideally one meter long and flexible enough to install.

8. Concealed Stop Cock:

The CP brass stop cock shall be of approved make and pattern as approved and as per the tender schedule. The 15mm nominal bore shall be designated by the nominal bore of the pipe outlet to which the stop cocks are normally fitted.

9. Mirrors:

The mirror shall be of superior glass with edges rounded off or beveled, as specified. It shall be free from flaws, specks or bubbles. The size of the mirror shall be 60 x 45 cm unless specified otherwise.

I. SOIL, WASTE, VENT, RAIN WATER PIPES

1. Pipes:

All pipes shall be straight and smooth and inside free from cracks and other manufacturing defect. Pipes shall be conforming to IS : 13952 type B for soil and waste and of type A for rain water pipes.

2. Fittings:

Fittings shall conform to the Indian Standard recommended for the pipes. Pipes and fittings must be matching IS specifications. Interchange of pipes of one standard to fitting of other standard will not be permitted. Fittings shall be of the required degree of curvature with or without access door.

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3. Fixing:

All vertical pipes shall be fixed truly vertical to the walls with approved type of flat “U” type clamps with anchor fasteners of approved design or 6 mm nuts and bolts. Branch pipes shall be connected to the stacks at the same angle as that of the fittings. No collars shall be permitted to the vertical stacks. Each stack shall be terminated at top with a cowl.

Horizontal pipes running along the ceiling shall be fixed on galvanized structural adjustable clamps of special design as directed. Horizontal pipes shall be laid uniform slope and clamp adjusted to the proper level and so that the pipe fully rest on them.

4. Clean Out:

Clean out pipes for Soil, Waste or Rainwater pipes laid under floors shall be provided near pipe junctions, bends, Tees, Y’s and on straight runs at such intervals as required as per site conditions.

J. WATER SUPPLY**1. General:**

It is most important to ensure that wholesome water supply provided for drinking and culinary purposes, is in no way liable to contamination from any less satisfactory water. There shall, therefore, be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for conveying or containing impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose.

2. Pipes and specials.

Pipes and specials shall be as specified in the tender schedule.

3. Cutting.

Pipe shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut which provides optimal bonding area within a joint.

4. Fitting preparation.

A clean dry rag /cloth should be used to wipe dirt and moisture on the fitting sockets and tubing ends. The tubing should make contact with the socket wall 1/3 and or 2/3 of the way in to the fitting socket.

5. Solvent Cement application.

Only CPVC solvent conforming to ASTM F-493 should be used for joining pipe with fittings. CPVC schedule 40 & 80 heavy bodied solvent cement only should be used confirming to ASTM F-493.

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K. DRAINAGE (Sewers & Storm water drain)

Sewer pipes and storm water drainage shall be to the required gradient and profiles. Locations of manholes / inspection chambers shall be got confirmed by the contractor from the Engineer-in-charge. As far as possible, no drains or sewers shall be laid in the middle of the road unless otherwise specifically shown on the drawing. Sewer pipes shall be laid and proved to be water tight. The excavation of trenches for sewer pipes, storm water drainage, chambers etc. shall be restored and maintained at ground level.

L. STRUCTURAL STEEL WORK**1. Scope of Work:**

The work covered by this specification consists of supply, fabrication and erection of structural steel components in accordance with the specifications and the applicable drawings.

2. Materials:

The structural steel shall be of standard sections as marked on the drawings and shall be free of scale, blisters, laminations, cracked edges and defects of any sort.

3. Workmanship:

- All workmanship shall be of first class quality in every respect to the greatest accuracy being observed to ensure that all parts will fit together properly on erection.
- All welding shall be done by qualified welders.
- All butt ends of compression member shall be in close contact through the area of joints.

4. Erection and Marking:

During erection, the work shall be securely braced and fastened temporarily to provide safety. No permanent welding shall be done until proper alignment has been obtained. All safety to be ensured while erection.

M. SEWAGE TREATMENT PLANT.**1 . General.**

The location, design, MEP, installation and testing of the STP shall be as per the drawings and specifications enclosed along with the tender and as per the KSPCB approvals received.

2. The Sewage Treatment Plant shall comprise of following:

Screen Chambers, Oil Separator and grit chamber, Sewage & Sullage collection tanks Anaerobic reactor, primary and secondary settling tanks, Flocculation tank Aeration Tanks, Sludge holding tank, Filter feed sump, Pressure sand filter and activated carbon filter, Bio gas plant, Air Blowers, pumps & equipments, Piping, valves etc, Electro Mechanical Equipments, Electrical works including panel boards, cabling to various motors, level controllers for automatic running of the plant, etc., Other Miscellaneous Items, Cutting holes, chases & like through all types of walls /floors and finishing for all, services crossings, including sealing, cover plates, making good structure and, finishes to an approved standard, testing & commissioning of the entire STP.

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3. Associated Civil works:

The civil works for construction of various units associated with Sewage Treatment Plant are included along with the BOQ for civil works. The following major components of the treatment plant shall be supplied by the contractor. In addition to supply, installation and commissioning of these components are included in your scope.

Sl. No	Item	Qty	Size	MOC
1	Screen Chamber	1	0.60x0.60x0.60m (invert level assumed as 60 cms. If any change, size should re-arrange)	RCC
2	Anaerobic baffled reactor- 1	1	2.0m x 2.10m x 3.30 m	RCC
3	Anaerobic baffled reactor- 2	1	1.0m x 2.10m x 3.30 m	RCC
4	Anaerobic baffled reactor- 3	1	0.95m x 1.450m x 3.3 m	RCC
5	Oil & Grease trap	1	0.75m x 1.25m x 2.0 m	RCC
6	Equalization Tank	1	3.10m x 1.90m x 3.3m	RCC
6	Sludge Tank	1	2.0m x 1.45m x 3.3m	RCC
7	Moving bed bio reactor	2	2.0m x 1.50m x 3.0m	RCC
8	Annoxication Tank	1	2.0m x 0.80m x 3.0m	RCC
9	Secondary Settling Tank (conical bottom)	2	2.05m x 2.0m x 3.0m	RCC
10	Filter Feed Tank	1	1.25m x 2.0m x 3.0m	RCC
11	Ultra Filtration Feed Tank	1	1.25m x 2.0m x 3.0m	RCC
12	Treated Water Tank	1	2.65m x 1.95m x 3.0m	RCC

4. List of Civil Works

1. All tanks are water retaining structures
2. Proper air vent pipes to all tanks are to be provided

5. Details of Mechanical / Electrical Equipments.

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Sl.No.	Item	Specification	Quantity
1	Bar screen	Size : 600x600 mm MOC : SS 304 place 8 mm SS rod at 12 mm apart	2 Nos
2	Water lift Pump	Capacity : 3 m3/ Hour Head : 25 m Type : Self priming MOC : Cast iron Make : Kirloskar, Lubi, CRI	2 Nos
3	Filter feed pump	Capacity : 3 m3/ Hour Head : 25 m Type : Centrifugal MOC : Cast iron Make : Kirloskar, Johnson, wilo	2 Nos
4	Blower	Capacity : 80 m3/ Hour @ 2.5 meter water depth Motor: 3 HP, with blower speed 1000-1200 RPM Type : Twin lobe blower MOC : Cast iron Make : Everest/ Akash/ A1	2 Nos
5	MBBR media	Model : K3 MOC : HDPE white Make :Aquatech internatonal/ cooldeck	5 m3
6	Bubble diffuser	Model : Fine bubble tubular diffuser 65 dia X 1000 mm Make : Anjaneya internatonal/ cooldeck	16 Nos
7	Dosing Pump	Capacity : 0-5 LPH Head : 25 m Type : Diaphram pump MOC : Liquid contact is with PP Make : E-dose/ Milton roy	3 Nos
8	Pressure sand filter	Size : 600 mm dia & 1600 mm height MOC : FRP – woven Make : Pentair / TATA Media : Graded Quartz sand	1 No
9	Activated carbon filter	Size : 600 mm dia & 1600 mm height	1 No

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		MOC : FRP – woven Make : Pentair / TATA Media : Activated Carbon IV-1000	
10	Ultra filtration Unit	Capacity : 4 m3/ Hour No of membranes : 4 No of skid : 2 (fabricated on MS) Feed pump : 1 (Centrifugal) Backwash pump : 1 Make: Membrane: Hitec, Pumps: Kirloskar	1 No
11	Panel Board	TOD Energy Meter to be included	1 No
12	Water meter	Water meter to be included in the outlet of treated water. Inlet/Outlet: 1.5"	1 No

N. FIRE PROTECTION WORK

1. Fire Pump:

Electrically driven high pressure centrifugal fire pump, suitable for automatic operation consisting of the following:

- Horizontal, end suction, high pressure single stage, single outlet centrifugal pump suitable for operation on 415 volts $\pm 6\%$, 3 phase, 50 Hz AC supply. The installation shall be complete with flexible coupling and coupling guard as required. Fire pump shall have CI casing, CS diffuser, cast iron impeller (hard finished and dynamically balanced) and carbon steel / stainless steel shaft with gland packing, ensuring a minimum pressure of 3.5 kg/cm² at the farthest or top most hydrant.
- The installation shall be complete with necessary pressure gauge with gun metal shut-off cock on delivery side. The pump shall be factory assembled and tested and shall be approved by the local fire authority.
- The pump shall be capable of furnishing not less than 150% of rated capacity at a head not less than 65% of the rated head. The shut-off head shall not exceed 120% of the rated head. Flow: 2280 lpm & head: 84 m.
- Squirrel cage induction motor, TEFC type, suitable for operation on 415 volts, 3 phase, 50 Hz AC supply, for the above pump with synchronous speed 2900 RPM, conforming to IP 55 protection and Class F insulation. The motor shall conform to IS 325 (latest revision) with flexible coupling and coupling guard complete.
- Common base plate for (a) and (d) fabricated from MS channels of suitable size.
- Suitable cement concrete foundation with plaster (design and drawing to be provided by the contractor while foundation will be done by others) complete with anti-vibration cushy foot mountings.

2. Jockey Pump:

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- a) Mon block pump suitable for operation on 415 volts $\pm 6\%$, 3 phase, 50 Hz AC supply. Pump shall have CI casing and CI impeller (dynamically balanced).
 - b) Squirrel cage induction motor TEFC type suitable for operation on 415V, 3 phase, 50 Hz AC supply for the above pump with suitable RPM including flexible coupling and coupling guard.
 - c) Common base plate fabricated from MS channel of suitable size.
 - d) Suitable cement concrete foundation with plaster, complete with anti-vibration cushy foot mountings.
- Flow: 2280 LPM
Head : 84 M.

3. Diesel Engine Driven Centrifugal Fire Pump:

- a) Supply of standby/back-up fire pump, horizontal end suction centrifugal pump with CI casing, CS diffuser, CI impeller (dynamically balanced) and carbon steel/SS shaft with gland packing, coupled to high efficiency radiator cooled diesel engine.
 - b) The system shall include control panel with automatic starting facility, activated by pressure switch and operated through 12V electric starter with battery and battery charger, battery leads, 100 liter diesel tank and exhaust pipe extended up to 6 m outside pump house.
 - c) Pump shall be capable of furnishing not less than 150% of rated capacity at a head not less than 65% of rated head. Shut off head shall not exceed 120% of rated head.
 - d) Common base plate fabricated from MS channels.
 - e) Suitable cement concrete foundation with anti-vibration cushy foot mountings.
- Flow: 2280 LPM
Head : 90 M.

4. Above Ground Piping :

- a) Only MS Class-B pipes (medium duty) shall be used for sprinkler and hydrant system. Pipes shall conform to IS 1239 medium duty ERW pipes and shall be free from scale, cracks, surface defects and flaws.
- b) Exposed pipelines shall be coated with one coat epoxy primer and two coats signal red paint. Surfaces shall be properly cleaned before painting.
- c) Pipes shall be supported using MS structural supports such as rods, channels, angles and flats. Supports shall be painted with primer and black enamel paint.
- d) Supports shall be designed to withstand the combined load of pipe, fittings, fluid and insulation.
- e) Vertical risers shall be straight, vertical and parallel to building columns, supported at each floor.

5. Underground Piping:

- a) Underground pipes shall be laid with minimum 500 mm cover below ground level. Mains shall not pass below buildings.
- b) Air release valves shall be provided at suitable intervals. Yard hydrants shall be located minimum 3 m and maximum 15 m from building face.

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- c) Pipes shall be protected with anti-corrosion wrapping tape over suitable primer. All foreign matter shall be cleaned before application.
- d) All pipe fittings such as bends, elbows and reducers shall be MS conforming to IS 1239 and capable of withstanding 150% of maximum working pressure.

6. Butterfly Valve (Wafer type):

Butterfly valves shall be wafer type with stainless steel / SG iron disc, lever operated conforming to IS 13095 PN16, with PTFE/Nylon bushings and nitrile O-rings, complete with hand lever and ISI mark.

7. Non Return Valve:

Cast iron single plate wafer type check valve PN-16 with SS-304 disc and nitrile rubber seat.

Shell Test Pressure: 24.5 kg/cm².

Seat Test Pressure: 16 kg/cm².

8. Ball Valve:

Ball valve with CI body conforming to IS 5312 PN-16 with ISI mark.

9. Sprinklers:

a) Horizontal Side wall type.

- Standard response 5 mm glass bulb
- Temperature rating 68°C
- K Factor 5.6
- Max Working Pressure 12 bar
- UL / UL-FM approved
- Forged brass body with SS finish.

b) Pendent or Recessed type.

Specifications same as above.

10. Flexible Drop:

Un- braided flexible sprinkler 1000 / 1500 mm length. Maximum working pressure 200 PSI, hydro test 263 PSI, burst pressure 875 PSI.

UL / FM approved.

11. Pressure Gauges:

Bourdon tube type with SS316 element, 100 mm dial, metric scale marking. Complete with snubber, isolation cock, nipples and fittings.

12. Pressure Switch:

Industrial type SPDT pressure switch with 1/4" BSP connection, suitable range 4 – 20 kg/cm² with adjustable differential.

13. Air Release Valve:

Gun metal body valve with male threaded ends as per IS 554 / ISO 7.

Shell Test Pressure: 24.5 kg/cm².

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Seat Test Pressure: 16 kg/cm².

14. Air Cushion vessel:

Fabricated MS vessel 200 mm dia × 1 m height complete with air release cock, drain valve and shut off valve.

15. Alarm Check Valve:

100 mm dia alarm control valve assembly complete with main valve, water motor gong, pressure gauge, drain valve and piping.

16. Flow Switch:

Supply, installation, testing and commissioning of 100 mm dia vane type flow switch for fire sprinkler/hydrant pipeline complete with weatherproof housing, micro switch contacts and wiring terminals.

17. Hydrant Valve:

Landing valve conforming to IS 5290 Type-A, ISI marked.

Seat test: 16 bar

Body test: 23 bar

18. Fire Hose:

RRRL delivery hose 63 mm × 15 m length, conforming to IS 636 Type A, with SS instantaneous couplings.

19. Hose Reel Drum:

Wall mounted MS hose reel drum with 30 m rubber hose, working pressure 7 kg/cm², ISI marked.

20. Branch Pipe:

SS 304 short branch pipe with 63 mm inlet and 20 mm nozzle, conforming to IS 903.

21. Hose Box:

MS fabricated 450 × 600 × 250 mm hose cabinet with glass front door for 1 hose and branch pipe.

22. Fire Brigade Inlet:

a) 4 Way Inlet Breeching

SS body with four 63 mm instantaneous inlets, non-return valves and blank caps.

b) 2 Way Tank Filling Inlet Breeching

SS body with two 63 mm instantaneous inlets.

23. Fire Extinguisher:

ABC stored pressure type 4 kg capacity, conforming to IS 15683 with ISI mark

24. Modular Fire Extinguisher:

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Automatic modular ABC extinguisher with MAP powder, manufactured as per IS 15683 / IS 14609.

25. Firefighting control panel

Supply, erection, testing and Commissioning of fully automatic motor control panel for fire pumps (Main electric pump; Diesel engine pump; Jockey pump) incorporating automatic Star Delta switch gear rated for the motor HP. The control panel mounting shall include necessary indication lamps for the RYB phase showing the power supply conditions ammeter with clear indications or motor full load current, voltmeter with selector switch etc. The panel shall duly paint with proper anti-corrosive lacquer and is of foot mounted type with all accessories as required etc. complete.

26. Fire Alarm system:

14 Zone conventional microprocessor fire alarm control panel, powder coated MS cabinet with LED display, zone indication, alarm silence/reset, fault monitoring and 24V DC output circuits.

System includes:

- Sealed lead acid battery 12V 7Ah
- Manual call point
- Audio alarm hooter
- Optical smoke / heat detector (UL listed).

27. Public Address system:

Designing supplying and installing of Micro Controller Based 14 Zone Talk Back System with Builtin Microphone & Builtin Mixer Amplifier. The work under this system shall consist of furnishing all materials, equipment's and appliances and labour necessary to install the said system, complete with equipments.

28. Cables & Conduits:

1C × 1 sq.mm copper wire ISI marked in 20 mm dia rigid PVC conduit with accessories.

29. Signage:

- a) LED Signages.
Self-contained rechargeable LED “EXIT / FIRE EXIT” sign boards with battery backup.
- b) Photo luminescent signages.
Signs for Fire Duct, Fire Assembly Point, Fire Pump Room, Fire Lift, size 100 × 300 mm.

O. LANDSCAPING

1. Scope of Work:

The scope of work includes site preparations, excavation of pits, supply and planting of trees, shrubs, hedges, lawn development, supply of good earth and manure, watering, maintenance and all other operations required for proper establishment of landscape works as per the instructions of Engineer-in-Charge.

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2. Site Clearance and preparation:

The contractor shall clear the site of weeds, wild growth, stones, debris, rubbish and other objectionable materials. The ground shall be leveled to the required slope and grade as indicated in the drawings.

3. Supply of Good earth:

Good earth shall be red earth obtained from approved sources, it shall be free from kankar, stones, root, insects or termites and other foreign materials.

4. Supply of Farm Yard Manure (FYM):

Farmyard manure shall be well-decomposed organic manure obtained from cattle sheds or approved farms. It shall be free from stones, debris, insects or termites.

5. Planting of Shrubs and Hedges:

Shrubs shall be planted in pits or trenches as per the direction of Engineer-in-Charge. Spacing between the plants shall be as per approved landscape layout. Plants shall be watered immediately after planting.

6. Lawn Development:

The lawn shall be developed by turfing. The developed area shall be leveled and cleared of weeds. The grass turf shall be placed closely together and joints shall be filled with fine soil. The lawn shall be rolled lightly. The watering shall be done immediately after turfing and regularly until establishment.

7. Watering:

All planted materials and lawn areas shall be watered regularly to ensure proper growth. Watering shall be carried out preferably during morning or evening.

II. ELECTRICAL WORKS**A. ELEVATORS****Supply, Installation, Testing & Commissioning of Lifts****1 Execution of Work/Workmanship**

- i. The work has to be executed as per the plans approved by the “OWNER” together with all such addition/alterations required to be made subsequently on best workmanship and in accordance with the particular specification and the following standards.
- ii. CPWD specifications for electrical works part III (lift, escalators) 2003 and part I

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(internal) -1994 revised as on date.

- a. Indian Electricity Act and the Rules issued there under up to date.
- b. Indian Standard Codes 17900 Part 1 & 2 for Safety, Design and Testing
- c. All local Electrical Inspectorate/CEA requirements

2 Standard and Specifications

For all materials and equipment IS-17900 Part 1 & 2 specifications shall be applicable where IS-specifications are not available, British Standard specifications shall become applicable. All specifications, standards, publications specified mean the latest editions of such publication with up-to-date amendments.

3 Electrical Wiring

- i. All the electrical works of supply and installation of panels for drive motors, switches and controls complete with wiring as per system requirement shall have the safety certificate from the Electrical Inspectorate/CEA.
- ii. All cables and other wirings in connection with lifts installation shall be of copper of suitable grade for the voltage at which these are intended to work and of ISI approved make. The AC Hoist motor and control panel will be connected to the main earthing.
- iii. All metal parts will be earthed by suitable size earth conductor. Suitable caution notice shall be fixed wherever necessary. Circuit, which supply current to the electric motor, shall be separate from trailing cable used for control and safety device. Trailing cable which incorporates from those which incorporate lighting and signaling circuit. Power wiring between controlling and main board and controller to various landings conforming to IS specifications. All cables shall be of suitable size. Where installation of rigid conduit presents difficulties, short length of flexible conduit may be used. The length of the cables shall be such that they are not subjected to strain due to movements of car from end to end.

4 Materials

All the materials to be supplied by the contractor shall be of the best quality complying with the relevant IS 17900 specifications. Materials to be used shall be subjected to the prior approval of the Owner before its use in the work.

5. Manufacturer's Catalogues & check lists

Two sets of following manuals/catalogues shall be supplied by the tenderer at the time of submission of tender and additional three sets shall be supplied along with the equipment. Manufacturer's catalogue giving detailed Specification of equipment offered, Installation, operation and maintenance manual, wiring diagram, Maintenance check chart etc. shall be supplied along with the equipment.

6. APPROVALS OF CEA/ ELECTRICAL INSPECTORATE

- i. Successful tenderer shall submit detailed working drawings showing position of equipment with foundation details and location of suspenders/supports with the details of suspending arrangements.
- ii. Contractor shall obtain the approval of CEA/ Electrical Inspectorate and other local authorities in accordance with the relevant clauses of Indian Electricity Rules/Local rules. Approval of contractor's drawings shall not absolve the contractor of any of his obligations to meet the requirements of specifications under

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the contract.

- iii. Two sets of completion-drawings incorporating all modifications from time to time shall be submitted to the Owner after completion of work.

7 TESTING OF INSTALLATION AFTER COMPLETION

On successful completion of the installation, following tests as per IS 4656-1968 shall be carried out to the full satisfaction of the Owner. The necessary weights and instruments for tests shall be arranged by the contractor during the tests.

8 DEAD LOAD TEST

This test shall be carried out by subjecting the equipment to the maximum dead load test for half an hour. Equipment should retain this load for the specific period without sign of permanent distortion.

9 OTHER TESTS

- i. Earth resistance of the installation shall be tested in accordance with section 8 of IS code practice 732-1963 amended up to date.
- ii. All relays, contacts, indicating lamps, interlocking arrangements, operating mechanism etc. shall be tested for their smooth and efficient operations to the entire satisfaction of Owner.
- iii. Noise level at the points of the equipment shall be measured at different loads and at rated speed to ensure that the noise produced is within the limits specified.

10 PAINTING

All exposed metal work (except aluminum or aluminum alloy) carried out under these specifications shall be properly painted with three coats of approved paints and wooden portions shall be given necessary preservative in hidden surfaces and two coats of varnish in exposed surfaces to arrive at a smooth glossy surface.

11 PROTECTIONS AGAINST FIRE ACCIDENT

Whole of the contained equipment and apparatus in the lift well shall be rendered fire resisting to the greatest possible extend.

12 EQUIPMENT SPECIFICATION

All materials, parts equipment and the lift car to be incorporated in the system shall be of highest standards and the latest practice in design and manufacture. It shall be of robust construction liberally rated and capable of operation, efficiently and economically under the service conditions and conforming to the following relevant IS specifications and associated specifications mentioned their in.

IS –17900 - Part 1 & 2 Guidelines for design, installation, testing, operation and safety

15 STRUCTURAL DETAILS / DRAWINGS

The drawings showing the building plans, with details of the lift wells, pits etc. are available. The dimensions of the lift wells and pits shown in the building floor plan are as per IS-17900 Part 1 & 2. The tenderer should design his equipment to suit these cut-outs.

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16 MACHINES

The machine shall be equipped with an arrangement for manual winding of the machine for testing purposes and for operation when the power supply fails. The equipment installed should be rated as per the system requirement for its efficient and reliable operations.

17 HOIST MOTOR

The hoist motor for the service lift shall be designed for elevator services. The motor is to be of required H.P and high starting torque and conforming to relevant IS specification amended up to date. The motor shall have class F insulation and minimum of IE3 class.

18 REVERSE PHASE RELAY

A reverse phase relay shall be provided on the individual controller to protect the lift equipment against phase reversal low voltage and phase failure switches. Switches/Relays shall have suitable contact to withstand wearing due to frequent make/break operation of the floor controller and in the contact hoist way.

19 MICROPROCESSOR BASED CONTROL

- a. Microprocessor Based Control should be provided with operational card file containing a logic board with a microprocessor chip, random access memory (R.A.M) and Erasable Programmable Read Only Memory (E.P.R.O.M) chips to monitor and take over the commands of the elevator. The system should have the following advantages:
 - i. Flexibility of programme.
 - ii. Better leveling
 - iii. Highly efficient handling of passengers
 - iv. Reduced waiting time
 - v. Shorter travel time
 - vi. Easier maintenance
 - vii. Communication for remote indication of the position and failure
- b. Following factors should also be provided in the microprocessor based controller: -
 - i. Auto fan ON –OFF
 - ii. Detection of stuck hall button
- c. The system should continuously monitor critical aspects of system health. Self-health diagnostic capabilities should be built into the control system to speed up troubleshooting and for monitoring from seven segment displays provided in the logic board. This should facilitate quick identification of fault and restoration to normal operation.
- d. The control system should have double electrical isolation between high voltage electrical signals and the electronic for maximum circuit protection reliability. The electrical control should give complete protection for the elevator equipment maximum safety for lift users.

20 COUNTER WEIGHT

The counter weight shall consist of cast iron weight and contained in rigid structural steel frame and shall be equal to the weight of complete elevator car plus approximately 45% of the capacity specified. Specification as given in clause 6 of IS 14665 (Part 4- Sec 3)-2001 should be complied with.

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The counter weight shall be of cast iron and consisting of sections and without frame and having not less than two suspension rods extending throughout the counter weight.

21 COUNTER WEIGHT GUARD

The contractor shall provide and install expanded metal, counter weight guard of required length at the bottom of the hoist way.

22 AUTOMATIC TERMINAL STOPS

The elevator shall be equipped with an automatic stopping device arranged to bring the car to a stop at the terminal landings, independent of the regular operating device. Final limit switches shall be so provided in the Hoist way operated by the car and so arranged as to stop the car and prevent its normal operation, should it travel beyond the zone of the normal stopping device. A device shall be provided to remove power automatically from the motor and break at the top and bottom terminals independently of the operation of the normal operating device.

All the elevators shall be provided with micro self leveling features that shall automatically bring the car to the floor landings. This micro self leveling shall within its zone, be entirely automatic and independent, of the operating devices and will correct for over travel or under travel and scope stretch. Maximum leveling inaccuracies expected shall be indicated in the offer.

23 ALARM BELL FOR PASSENGER LIFT

Battery operated emergency alarm bell should be solid state siren type operated by and including wiring and an automatic battery charger of suitable capacity shall be provided and connected to a plainly marked push button in the car operating panel.

24 CAR AND CAR FRAME

- a. The internal dimensions of the lift car shall be of suitable size for the specified load and in accordance with statutory requirements.
- b. The passenger car shall be provided with vibration isolation pads to prevent vibration, being transmitted from the ropes and guide shoes. Lateral and upward motion of the car shall be restrained by locking blocks but there should not be metal to metal contact between the car and the frame. The top of the car shall be held firmly by rubber braced clamps welded to each side of the car canopy. In Addition panels shall be coated with a layer of bituminous sound deadening
- c. compound. The car frame shall be of suitable steel section properly and securely braced and shall be sufficiently rigid to withstand the operation of the safety gear. Passenger lifts shall be of metal construction with SS Hairline lacquer finish inside. The thickness of metal sheet used for construction should be adequate and not less than 2mm.
- d. The floors of all the lifts cars shall be provided by customer.
- e. Each lift shall be equipped with the following:-
 - Lighting :** Adequate LED lighting fixture complete with all accessories. This shall be operative during power failure.
 - Fan: Fan shall be provided.
 - One specification plate showing rated load, speed and other installation details

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and ratings.

- car operating panel with indication.
- Lift inspector's inspection certificate duly framed.
- Dos or Don'ts for lift operation duly framed.
- One specification plate showing rated load capacity and other installation detail/rating.
- A key operated switch shall be provided in the car to be operated by an attendant.
- When the car is on independent service, it should respond to car-buttons only.
- Battery operated alarm bell & emergency light firemen's switch at main lobby for each elevator over load warning indicators in car.

25 AUTOMATIC DEVICES FOR CUTTING OFF POWER

Efficient automatic devices shall be provided and maintained in each lift where by all power shall be cut-off from the motor before the car of balanced weight lands on the buffers.

26 EMERGENCY SAFETY DEVICES

Every lift suspended by wire ropes 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 at with full rated load in the car at tripping speed. Safety gear shall operate to stop and sustain the lift car in the event of lift exceeding the predetermined maximum speed in the descending direction when a speed governor is fitted. Every safety device shall operate positively and mechanically independent of any spring used in the construction, design will conform to IS-17900 PART 1 & 2. The safety systems should operate independently of man power supply since it must be able to function in circumstances where normal control system is at fault.

- i. Car Entrance, Car doors and landing doors
- ii. Entrance to the lift car shall be on one side in all floors.
- iii. The car landing doors for the lift car shall be power opening and closing with pushbutton.
- iv. This shall be fitted to the drive and shall automatically cut off the supply if the rope becomes slack. Suitable instantaneous safety switch will be provided for complete safety in the event of rope slack.

27 CONTROLLER UNIT

- i. The controller unit shall be of V3F drive system specially designed for lifts. This system should regulate the speed of the motor by altering the voltage and frequency fed to motor. The V3F shall be fully electronic motor controller which should be capable of adjusting the rotating speed of the 3 phase RC motor on a continuous basis. The leveling accuracy should be +/- 5mm. The power consumption must be reduced to 50% as compared to conventional drives.
- ii. The controller shall be located and shall be suitable for the control system and facilities required in car and landings. All control wiring shall be suitably secured and conform

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- to standard wiring practice.
- iii. The drive module shall require the speed of the motor. The drive module shall be interfaced with the elevator control computer which issues start stop and operating mode commands. The drive shall absorb only active current so that power factor will be close to unity.
 - iv. The interruption of the electric circuit shall stop and/or shall prevent the movement of car.
 - v. The controller unit and operating device shall be provided according to best elevator practice and complying with the applicable Indian Standards as adopted by ISI.
 - vi. Inspector's change over switch and a set of test buttons shall be provided at a suitable place. Operation of Inspector's change over switch shall make both the car and landing buttons inoperative and permit the lifts to be worked on corresponding test buttons in either direction for purpose of test by pressing.
 - vii. All control circuits should be fused with HRC fuses or otherwise protected against faults or overloads independently of the main circuits.
 - viii. The voltage of any control circuit shall not exceed the low voltage of 110volts. The control circuit shall be suitably protected independently.

28 CONTROL SYSTEM AND OPERATION

1. Independent car operating panel shall be provided in each car operating panel to enable a car to be operated by an attendant.
2. Besides, the lift operation shall meet the following requirements:-
3. It shall not be possible to start the lift car under normal operations unless every landing doors and car doors are in the closed position.
4. The landing push buttons shall be inoperative during the whole time an occupied lift car is in use. The landing push buttons shall remain inoperative until the person using the lift, have vacated the lift car and the landing doors again have been closed.

29 LIFT CONTROL

The operation of the elevator shall be full collective. In the car each landing level will be serviced by buttons. At the landings, wherein the calls are registered by momentary actuation of the landing buttons are made in order, in which the landing are reached in each direction of travel after the buttons have been actuated. With this type of operation the "UP" direction and all "DOWN" landing calls are answered when the car is traveling in "DOWN" direction, except in the case of upper most and lower most calls which are answered as soon as they are reached irrespective of directions of travel. After the car stops at a landing in response to a call or landing call, the car will remain in-operative from the landing buttons for a predetermined interval.

30 Elevator Monitoring System

- The controller shall be fitted with a communication port so that the movement breakdown of the lifts can be recorded in the BMS system already available in the hotel.
- The contractor has to include all minor building work, steel scaffolding and other items that is required for successful completion of the lift erection.
- The contractor has to visit the site before quoting and ensure the sizes of the well and include all that is required to house.

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Specification of 15 Passenger Elevator

Elevator Type	Passenger elevator
Product	Machine room Less
No of Units	1
Load & Capacity	1020 kg or 15 persons
Speed	1 m/s
Stops & Openings	12 stops & 12 openings, Single entrance car
Total no of opening	1 entrance
Main PowerSupply	AC 3 Phase, 50 Cycles, 415 Volts $\pm 10\%$
Drive System	Micro Processor Based VVVF
Control system	Microprocessor Based Simplex Selective Collective Control With / Without Attendent
Travel height	33.6 m
Elevator Grouping	Simplex
Well Dimension	Full Collective Control
Head Room height	2400 mm width and 3050 mm depth
Pit Height	4200 mm
Car dimensions	1850 mm
Door dimensions	1000 mm wide x 2400 mm deep x 2200 mm high (Suitable for well size)
Door type	900 mm wide x 2100 mm internal height (Suitable for car dimentions)
Motor	Two-panel center opening Plain Panel
	Efficiency shall be IE 3 or above

Finishes – Shall be approved by the engineer in charge prior to finalization

Car design	Comply with IS 17900 Part 1 & 2
Car Panel Finish	Brushed stainless 304 Grade
Handrail	Round Bend Handrail Silver brushed stainless steel at Rear Wall
Ceiling & Lighting	Integrated roof Brushed stainless steel 304 Grade Square Spot Light LED
Flooring	As provided by the supplier
Car & Landing Door Finish	Brushed stainless 304 Grade

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Car operating panel	1 Full Height SS 304 Grade Segmented LCD display Square surface mounted Buttons with braille buttons
Landing Signalization	Silver brushed stainless steel 7 segment display Flush Mounted Square with braille
Landing Operating Panel (LOP)	KDS90
Location LOP	Wall
Faceplate Material:	Stainless Steel – Hairline Finish

Features Required

Standard Features	<p>Correction drive to next level</p> <p>Emergency Alarm @ Main Floor</p> <p>Car Call backwards</p> <p>Overload function, constant indication/Buzzer</p> <p>Bypass load Function</p> <p>Auto Cut off Fan and Light</p> <p>Manual Rescue Operation</p> <p>Automatic Rescue Device with audio announcer</p> <p>Centralized Hoisting for lesser vibration and smooth travel</p> <p>Pit Ladder</p> <p>Micro movement Led Based Buttons</p> <p>Load Weighing Device</p> <p>Direction & Position Indicator in Car & Landing</p> <p>Advanced Car Position Indication</p> <p>Automatic Brake Test function every 11hours</p> <p>Every run brake supervision</p> <p>Phase reversal functioning</p> <p>+10% to –10% Voltage Fluctuation Withstanding Capacity</p> <p>Door Close Button</p> <p>Door Open Button</p> <p>Car Emergency Light</p> <p>Curtain of Light 169 Beams</p> <p>Accurate Relevelling, Automatic, Closed Door</p> <p>Emergency opening device</p> <p>Over speed governor</p> <p>Fireman switch</p> <p>Battery Operated Emergency Alarm Light</p>
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Additional Features	Advanced Door Opening Attendant Service Lift Announcer Square Spotlight LED 2 Hours Fire rated doors Cat 6 cable to be provided with travelling cable for providing CCTV inside the CAR. Telephone inside the CAR with necessary cabling.
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Specification of 10 Passenger Elevator

Elevator Type	Passenger elevator
Product	Machine room Less
No of Units	1
Load & Capacity	680 kg or 10 persons
Speed	1 m/s
Stops & Openings	12 stops & 12 openings, Single entrance car
Total no of opening	1 entrance
Main Power Supply	AC 3 Phase, 50 Cycles, 415 Volts $\pm 10\%$
Drive System	Micro Processor Based VVVF, Microprocessor Based Simplex
Control system	Selective Collective Control With / Without Attendant
Travel height	33.6 m
Elevator Grouping	Simplex Full Collective Control
Well Dimension	1925 mm width and 2175 mm depth
Head Room height	4000 mm
Pit Height	1850 mm
Car dimensions	1200 mm wide x 1450 mm deep x 2200 mm high (Suitable for well size)
Door dimensions	800 mm wide x 2000 mm internal height (Suitable for car size)
Door type	Two-panel centre opening Plain Panel
Motor	Efficiency shall be IE 3 or above

Finishes – Shall be approved by the engineer in charge prior to finalization

Car design	Comply with IS 17900 Part 1 & 2
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Car Panel Finish	Brushed stainless 304 Grade
Handrail	Round Bend Handrail Silver brushed stainless steel at Rear Wall
Ceiling & Lighting	Integrated roof Brushed stainless steel 304 Grade Square Spot Light LED
Flooring	As provided by the supplier
Car & Landing Door Finish	Brushed stainless 304 Grade
Car operating panel	1 Full Height SS 304 Grade Segmented LCD display Square surface mounted Buttons with braille buttons
Landing Signalization	Silver brushed stainless steel 7 segment display Flush Mounted Square with braille KDS90

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Features Required

Standard Features	Correction drive to next level Emergency Alarm @ Main Floor Car Call backwards Overload function, constant indication/Buzzer Bypass load Function Auto Cut off Fan and Light Manual Rescue Operation Automatic Rescue Device with audio announcer Centralized Hoisting for lesser vibration and smooth travel Pit Ladder Micro movement Led Based Buttons Load Weighing Device Direction & Position Indicator in Car & Landing Advanced Car Position Indication Automatic Brake Test function every 11hours Every run brake supervision Phase reversal functioning Signal Fixtures +10% to -10% Voltage Fluctuation Withstanding Capacity Door Close Button Door Open Button Car Emergency Light Curtain of Light 169 Beams Accurate Releveling, Automatic, Closed Door Emergency opening device Over speed governor Fireman switch
Additional Features	Battery Operated Emergency Alarm Light Advanced Door Opening Emergency Rescue Device with audio announcer Attendant Service Lift Announcer Square Spotlight LED 2 Hours Fire rated doors Digitally Connected Service for maintenance Cat 6 cable to be provided with travelling cable for CCTV inside the CAR. Telephone inside the CAR with necessary cabling.

Approved Makes of Passenger Lift

KONE Elevator India Pvt. Ltd, OTIS Elevator Company India Ltd, Fujitech India Pvt. Ltd, Schindler, Johnson Lifts Pvt. Ltd, Thyssen krup, Mitsubishi Electric India Pvt. Ltd or substantially equivalent makes.

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B. TECHNICAL SPECIFICATION ELECTRICAL

SECTION- I GENERAL REQUIREMENTS FOR ELECTRICAL WORKS

1 GENERAL

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The requirement offered by the contractor shall be complete in all respects. Being a Turnkey project, any materials or accessories which may not have been specifically mentioned, but which are usual and necessary for the satisfactory and trouble-free operation and maintenance of the equipment shall be provided without any extra cost. This shall also include spares for commissioning of the equipment. The contractor shall obtain all sanctions electrical loads, approval of drawing/ etc. from the concerned authorities and permits required for the electrical installation work. All actual fee payable in this regard will be reimbursed by CSL against submission of original receipt/documentary evidence. On completion of work, the contractor shall obtain NOC from various statutory bodies as applicable namely KSEBL, Kerala State Pollution Control Board, Kerala State Electrical Inspectorate Central Electricity Authority (CEA) etc and a copy of the same shall be submitted to OWNER. Contractor shall be responsible for liasoning with KSEBL/CEA and other authorities till commissioning and getting electricity in the complex.

OWNER shall have full power regarding the materials or work got tested by independent agency at the electrical contractor's expenses in order to prove their soundness and adequacy. The contractor will rectify the defects/suggestions pointed out by OWNER/ independent agency at his own expenses. The installation shall comply in all respects with the requirements of Indian Electricity Act 2003, Indian Electricity Rules (IER) 1956, CEA regulation 2023, Works manual CPWD 2022, NBC 2016, Relevant IS codes, IEC codes etc and their amendments till date. The bidder is liable to furnish the list of authorized licensed persons/ employed/deputed to carry out the works/perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 or latest amendment as amended up to date.

The installation and equipment offered shall further confirm to standards stipulated by supply authorities, CEA, KSEBL and any other statutory bodies. Modifications if any suggested by the authorities during their inspection shall be carried out at site without any extra cost.

2. SCOPE - ELECTRICAL SERVICES

The bidder shall supply, install and commission along with requisite spare, maintenance tools and tackles the following equipment and system in the Project. The scope also covers the detailed engineering and calculations of the various equipment/system mentioned hereunder and the same shall be approved by the OWNER/Engineer-in-charge prior to execution of the job.

- Switchgears.
- Light fixtures.
- Wiring devices – switches & sockets
- Earthing.
- Lightning protection system.
- Laying and termination of cables.
- Bus duct / Rising Main / Distribution Boards / Sub-Distribution Board.

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- Providing power supply to mechanical/ equipments
- Complete internal building wiring as per specification.
- Safety to personnel and equipment during both operation and maintenance.
- Reliability of Service.
- Minimum fire risk.
- Ease of maintenance and convenience of operation.
- Automatic protection of all electrical equipment through selective relaying system.
- Electrical supply to equipment and machinery within the design operating limits.
- Adequate provision for future expansion and modification.
- Maximum interchange ability of equipment.
- Fail-safe feature.
- Suitability for applicable environmental factors.

Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations. All work to be performed and supplies shall be affected as a part of contract requires specific approval/ review of OWNER or his authorized representative. Major activities requiring approval/ review shall include but not be limited to the following:

- Basic engineering documents e.g. overall single line diagram, area classification drawing, overall cable layout, testing, type test report, guaranteed particulars of all equipment and maintenance manuals.
- Quality assurance procedures.
- Field testing and commissioning procedures.
- Basic engineering calculations viz. load analysis; load flow, fault level calculations, and voltage drop calculations during motor start-up/re-acceleration etc.
- Control and protection schemes.
- Load sharing and annunciation scheme,
- Sizing calculation for cable trays/cable trenches.
- Area-wise illumination level calculation and preparation of power supply distribution drawing.
- Calculation for earthing system and lightning protection.

The Contractor shall be responsible for:

- Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, lighting layouts, cabling layouts, earthing and lightning protection layouts, including equipment installation and cable termination details etc. prior to start of work.
- The Contractor shall be responsible (before commencing work) for checking all levels and gradients shown on Drawings and for relating them to site conditions to ascertain that the condition on site permit execution of work as shown on the Drawings.
- Preparation of bill of materials for cabling, lighting, earthing and miscellaneous items etc.
- Cable schedule.
- Lighting/power panel schedule.
- Interconnection drawing.
- Protection co-ordination drawings/tables for complete power system.

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- Shop inspection and testing procedures.
- Field testing and commissioning procedures.
- Preparation of as built drawings for all services.
- Any other work/activity which is not listed above however is necessary for completeness of electrical system.

3. CODES & STANDARDS

The design engineering manufacturing and the installation shall be in accordance with established codes, sound engineering practices, and specifications and shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities' e.g. Electrical inspector/CEA, pollution control boards, KSEBL as applicable before commissioning of electrical works.

- Indian Electricity Act.
- Indian Electricity Rules.
- CES regulation 2023.
- Factory Act.
- Pollution Control Act.
- Works manual – CPWD 2022
- NBC 2016 including its amendments till date.

IS-732: Code of practice for electrical wiring installation system voltage not exceeding 650V.

IS-3043: Earthing.

IS-2309: Code of practice for the protection of buildings and allied structure against Lightning

IS-7689: Guide for control of undesirable static electricity.

IS-3716: Insulation co-ordination application guide.

IS-8130: Conductors for insulated electrical cables and flexible cords.

IS-5831: PVC insulation and sheath of electric cables.

IS-3975: Mild steel wire, strips & tapes for armouring cable.

IS-3961: Current rating of cables

IS-694: PVC insulated (heavy duty) electric cables for working. Voltage up to and including 1100 volts.

IS-424- 1475 (F-3): Power cable flexibility test.

IEC-439/IS-7098: Specification for cross linked polyethylene insulated PVC sheathed cable for working voltage up to 1.1 KV.

IS-1554: PVC insulated cables up to 1100 volts.

IS-10810: Test procedures for cables.

IS-6121: Cable glands.

IS-10418: Cable drums.

IEC-754(1): FRLS PVC insulated cable.

ASTM-D-2863: Standard method for measuring minimum oxygen concentration to support candle-like combustion of plastic (oxygen index).

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- ASTM-D-2843: Standard test method for measuring the density of smoke from burning or decomposition.
- ASTM E-662/IEC 754(A) Standard test method for specific optical density of smoke generated by solid materials.
- IEEE-383: Standard for type test class-IE, electric cables, field splicers and connections for power generation station.
- IS 13947/IEC 947: Air circuit breaker/moulded case circuit breaker.
- IS-8623: Specification for factory built assemblies of switch gear and control gear for voltage upto and including 1000vac/1200vdc
- IS1018: Switchgear and control gear selection/installation and maintenance
- IS-1248: Direct acting indicating analogue electrical measuring instruments and testing accessories.
- IS-13779: Digital measuring instruments and testing accessories.
- IS-3156: Voltage transformer
- IS2705: Current transformer for metering and protection with classification burden and insulation.
- IS -2147: Degree of protection provided by enclosures for low voltage.
- PART I, II, III Switchgear and control gear
- IS-3427: Metal enclosed switchgear and control gear
- BS-162: Safety clearance
- IS-3202: Code of practice for climate proofing of electrical equipment.
- IS-375: Marking and arrangement for switchgear, bus bars, main connections and auxiliary wiring.
- IS-722: Ac electric meters
- IS-3231 /IEC-255: Electrical relays for power system protection.
- IS-5082: Electrolytic copper/aluminium bus bars
- IS-2834: Capacitors
- IS-2713: Steel tubular pole
- IS-335: Specification for insulating oil
- IS-3837: Specifications for accessories for rigid steel conduit for electrical wiring.
- IS-2026& 335: Distribution transformer (PART I, II, III) GI/STEEL /PVC conduit pipe for electrical wiring.
- IS-2274: Code of practice for electrical wiring installation system voltages exceeding 650 volts.
- IS-6665: Code of practice for industrial lighting
- IS-3646: Interior insulation part 1&2
- IS-1944: Code of practice for lighting of public through fares.
- IS-7752: Guide for improvement of power factor consumer's installation.
- IS-13346: General requirement for electrical for explosive gas atmosphere.
- IS-13408: Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres

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- IS-12360: Voltage and frequency for ac transmission & distribution system.
- IS-5572: Classification of hazardous area for electrical installations.
- IS-5571: Guide for selection of electrical equipment for hazardous area.
- IS-4201: Application guide for Current Transformer
- IS-4146: Application guide for Voltage Transformer
- IS-10028: Code of practice for installation and maintenance of transformer
- IS-8478: Application guide for on load tap changer
- IS-10561: Application guide for power transformer
- IS-1646: Code of practice for fire safety of buildings electrical installation
- IS-3034: Code of practice for fire safety of industrial building-electrical generating and distribution station
- IP-30: National electrical code (NEC) BIS publication.
- IS-4722: Rotating electrical machines.
- IS-4889: Method of determination of efficiency of rotating electrical machines.
- IS-325: Three phase induction motors.
- IS-4729: Measurement and evaluation of vibration of rotating electrical machines.
- IS-900: Installation and maintenance of induction motors.
- IS-4029: Air break switches.
- IS-2208-9224: HRC cartridge fuses.
- IS-2959: Contactors.
- IS-9537: Rigid steel conduit.
- IS-1030-1982: Specification for carbon steel castings for general engineering purpose.
- IS-1601/ BS-649: Performance & testing of Internal Combustion (IC) engines for general purpose.
- AIEE-606(1959): Recommended specification for speed governing of I.C. engine generator units.
- BS-5514/IS-3046 8528(Part-2): Reciprocating IC engine driven A.C. generators.

Any other standard may be followed provided it is equivalent or more stringent than the standards specified above. In case of any deviation /conflict of this specification with the codes & standards, the following order of precedence shall govern.

- Specification, particular specification if any, and drawings.
- Indian regulations/codes and standards.

4 SITE CONDITIONS

- Design ambient 50 Deg.C. Maximum, 2 Deg. C. minimum
- Relative Humidity 85% maximum
- Site environment Normal

5 DESIGN CRITERIA

I Electrical Details of Incoming Supply

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- a. Supply Voltage – 11 KV As per KSEBL approved.
- b. Fault level (Sym) at supply of point design - 350 MVA (to be confirmed from State Electricity Board by Tenderer).
- c. Neutral Earthing - Solid Earthing
- d. Voltage Regulation - $\pm 10\%$
- e. Frequency Regulations - $\pm 3\%$
- f. Combined - ± 10

6. DRAWINGS

a). The drawings along with specifications are attached with the tender documents. These drawings are meant to give general idea to bidder regarding the nature of work covered by these specifications.

b). any information/data shown/not shown in these drawings shall not relieve the contractor of his responsibility to carry out the work as per the specifications. Additional information required by the bidder/tenderer for successfully completing the work shall be obtained by him.

c). Shop Drawings

The contractor shall prepare detailed coordinated electrical shop drawing indicating lighting/ lighting fixtures, ceiling/exhaust/wall fans, position of switches, socket outlets, isolators for equipment, distribution boards for various services, cables, cable trays, M.V. Panel Boards/Relay Panel, PCC, DB's, Cable Schedule with other relevant services and submit to the Engineer-in-Charge for approval before commencing the work.

The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. PCC's, MCC's, cable schedule and routes, manhole trap and fixing details as well as for conduit indicating run and size of wire/cables, outlet/pull/junction boxes etc. with fixing details, mounting heights etc. for the above-mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings does not relieve the contractor of his responsibility for providing maintenance free and fool proof system including any missing component/ accessories to meet with the intent of the specifications. Contractor will submit 2 prints for preliminary approval and finally six prints as working copy for distribution.

d). Coordination drawing

In case of locations where false ceiling is available, contractor shall prepare coordination drawings for below and above false ceiling services.

Contractor shall commence the work only after getting approval of coordination drawing from engineer in charge.

e). Completion Drawings/As Built Drawings

On completion of the work and before issue of certificate of virtual completion, the contractor shall submit to the OWNER 4 sets along with soft copy of 'As Built' drawings (in AutoCAD & PDF format) of the work along with 01 Nos. cloth tracing originals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution along with warrantee & guarantee certificates from manufacturers.

These drawings must provide:

- Run and size of conduit, inspection and pull boxes including routing and locations.

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- Number and size of wires in each conduit.
- Locations and rating of sockets and switches controlling the light and power outlet.
- A complete wiring diagram as installed and schematic drawings showing all connections in the complete electrical system.
- Location of outlets of various services, junction boxes, light fixtures.
- Location of all earthing stations route and size of all earthing conductors.
- Layout and particulars of all cables.
- Location and details of electrical panels, Feeder Pillars with description and detailed control wiring diagram.
- Location of Hume pipe and manhole including HT/LT cable layout and scheduling.
- Layout of cable trays with support and their fixing details.
- Location/layout of all earthing station, route and size of all earthing conductor.
- Lightning protection system layout.
- Position of LT Switch Boards.

The recommended position of the switch boards, as shown on the layout drawings will be adhered to as far as practicable. The contractor shall submit 2 sets of samples of each type of accessories and apparatus, proposed to be used in the installation at site for approval (drawings or samples) as required and the choice of selection out of the approved list lies with the OWNER. For all non-specified items, approval of the OWNER shall be obtained prior to procurement of the same. Contractor shall prepare all drawings / working drawings required to be submitted to the Electrical Inspectorate/CEA / KSEBL / any other statutory bodies and obtain necessary approvals.

7. MANUFACTURER'S INSTRUCTIONS

Where manufacturers have furnished specific instructions, relating to the material/equipment to be used on this job, covering points not specifically mentioned in this document, manufacturers' instructions should be followed.

8. MATERIALS AND EQUIPMENT

All the materials and equipment shall be of the approved make and design. Unless otherwise called for any approval by OWNER's Engineer-in-Charge, only the best quality materials and equipment shall be used. The contractor shall obtain approval from the Engineer in charge for all materials prior to their usage, the contractor shall submit manufacturer's details and get them approved before ordering. The contractor shall arrange for a mock-up of all specified works intimated by the engineer in charge, which must be approved by the Engineer in charge before commencing the work.

1. GENERAL DETAILS AS REQUIRED

a). Space Heaters.

One of more adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in major panel compartment as instructed by the engineer in charge. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation.

b). Fungistatic Varnish

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Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

c). Ventilation Opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

d). Degree of Protection

The enclosures of the Control Cabinets, Junction Boxes and Marshalling Boxes, Panels etc. to be installed shall provide degree of protection as called for in specification / BOQ whenever it is not mentioned it shall be as given below.

- Installed out door: IP-56.
- Installed in covered area: IP-52.
- Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-42.
- For L.T. switchgear (AC and DC distribution boards): IP-52.

The degree of protection shall be in accordance with IS: 13947 (Part-I)/IEC-947 (Part-I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

e). Rating Plates, Name Plates and Labels of electrical items installed in the building are to permanently attach to it in a conspicuous position. A rating plate should be of non-corrosive material with engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions of equipment. The rating plate of each equipment shall be according to IEC requirement.

f). First Fill of Consumables, Oil and Lubricants

All the first fill of consumables such as fuels, oils, lubricants, filling compounds, touch up paints, welding/soldering/brazing material for all copper/G.I. earthing and essential chemicals etc. which will be required to put the equipment/scheme covered under the scope of the specifications, into successful operation, shall be considered by the Contractor.

2. QUALITY ASSURANCE PROGRAMME

To ensure that the major equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Purchaser's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be outlined by the Contractor in the bid. A quality assurance programme with respect to the major equipment shall generally cover the following:

- a). His organization structure for the management and implementation of the proposed quality assurance programme.
- b). Documentation control system.

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- c). Qualification data for bidder's key personnel.
- d). The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- e). System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
- f). Control of non-conforming items and system for corrective actions.
- g). Inspection and test procedure both for manufacture and field activities.
- h). Control of calibration and testing of measuring instruments and field activities.
- i). System for indication and appraisal of inspection status.
- j). System for quality audits.
- k). System for authorizing release of manufactured product to the Purchaser.
- l). System for maintenance of records.
- m). System for handling storage and delivery.
- n). A quality plan-detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his Vendor's quality management and control activities.

3. INSPECTION, TESTING AND INSPECTION CERTIFICATE

OWNER or duly authorized representative may conduct Inspection of major equipments at any stage of manufacture, dispatch or at site and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

Equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports as applicable for approval. The Contractor shall intimate the OWNER the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. Contractor shall arrange factory acceptance test for DG, Transformer, RMU/VCB, LT panels, Busduct & any other specialized electrical equipment which is eventually required to complete the project. Contractor shall arrange the factory inspection at his cost. The equipment shall be dispatched to site only after approval of test reports and issuance of clearance by the OWNER.

The OWNER reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Contractor.

4. TESTS

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the OWNER and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S.

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5. PACKAGING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. OWNER takes no responsibility of the availability of any special packaging/transporting arrangement. Any items suffering from damage during manufacture, or in transit, or on site whilst in storage or during erection shall be rejected and replaced by the contractor without extra cost.

6. PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

7. HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.

"All materials delivered to the site shall be stored securely, the contractor shall be responsible for all materials until they are handed over to CSL".

17. PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts.

18. DESIGN CO-ORDINATION

The Contractor shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinated performance of the entire system.

19. SPECIAL REQUIREMENTS

➤ Electrical contractor shall have a valid 'Class A' licence from the Kerala state Electricity licensing Board. Copy of the same shall be submitted along with the offer/prior to commencement of the work.

➤ Electrical contractor shall deploy One graduate electrical engineer with at least 3-year experience with valid supervisory license or One Diploma electrical engineer with minimum of 4 years' experience with valid supervisory license.

A Project Manager holding a degree in Electrical Engineering with a minimum of 8 years of experience shall be made available for the project as and when required by the Owner. He shall be responsible for all electrical works.

➤ Contractor shall work in coordination with other agencies involved in the project.

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Obtaining statutory approval from CEIG Kerala/CEA and KSEBL with necessary power sanction and service connection will be an integral part of this contract. All necessary documents including the drawings for approval shall be prepared by the contractor.

20. GENERAL ELECTRICAL REQUIREMENTS

20.1 BUS BARS

The switchboard shall comprise of 3 phase bus bars and a neutral bus bar, which shall extend through all panels of the switchboard. All phase bus bars shall be of uniform cross section throughout the switchgear board and shall be suitably sized to carry continuously the required current. Bus bars shall be housed in a separate chamber and shall be accessible for inspection only with specified tools.

Bus bars shall be of HDHC electrolytic grade Copper or aluminium and shall be insulated with colour heat-shrinkable sleeves throughout their length and the same shall be arranged in accordance with IS375. However, at joints good quality shrouds shall be provided. Bus bars shall be supported at regular intervals and both, bus bars and the supports shall be adequately size and braced to withstand the specified short circuit level without permanent deformation. Dynamic stress shall be calculated on the basis of the specified peak short circuit. All bus bar supports shall be of non-carbonizing material resistant to acids and alkalis and shall have non-hygroscopic characteristics such as SMC, DMC epoxy bonded fiberglass. The busbars shall be air insulated and made up of high conductivity, electrolytic Aluminium or copper. Minimum electrical clearances shall be maintained between phase, neutral and body as per standards. The insulation used shall be non - hygroscopic and shall be treated for preventing fungus growth. For each and every tapping from the bus bars, separate connections shall be made. No direct tapings from the bus bar shall be made for any feeder without control and protection. All interconnections shall be by rigid bus bars only. Wherever lugs are used for terminated of rigid bus bars, it shall be soldered and not crimped.

20.2 CONTROL WIRING:

Inside the panels, the wiring for control, signaling, protection and instruments circuits shall be done with PVC insulated copper conductors. The insulation grade shall be 1100 V. The wiring shall be enclosed in plastic channels or neatly bunched together. Each auxiliary circuit wire shall be identified at both ends by PVC ferrules. Shorting links shall be provided for all C.T. terminals. For CT circuits PVC insulated 2.5 mm² copper conductor cables shall be used. Other wiring shall be carried out with PVC insulated 1.5 mm² copper conductor cables. Supporting facilities shall be provided for clamping the control cables. Cables lugs and requisite cable glands for these cables are also included in the scope of supply of the switchboard. All auxiliary circuits shall be protected by HRC fuses or mcb bearing identification labels. 1.5 sqmm size wires shall normally be used provided if the control fuse rating is 10 Amps or less. For 16 Amps control fuse circuit 2.5 sqmm size wires shall be used. Conductors shall be terminated with adequately sized compression type lugs. "Elmex" (direct conductor termination) type terminals will be acceptable for wires up to 10 sq.mm size and bolted type terminals with crimping type copper lugs shall be provided for all outgoing cable connections larger than 10 sqmm.

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Control & indication:

Breaker position (ON/OFF/spring charged/ test position/ service position) shall be indicated. Electrical indications with colours as given below shall be provided:

Breaker 'ON'	-	Red lamp
Breaker 'OFF'	-	Green lamp
Breaker 'Auto trip'	-	Amber lamp
Trip ckt healthy	-	White lamp
DC fails	-	Blue lamp

Control switches:

All control switches shall be rotary back-connected types, having a cam operated contact mechanism. Unless otherwise stated circuit breaker control switches shall be 3 positions spring return to neutral from both 'ON' and 'OFF' positions. Two 'spare' ways shall be provided on these switches.

20.3 EARTHING ARRANGEMENTS:

All cubicles shall be connected to an earth bus bar running throughout the length of the switchboard. The earth bus shall be copper flat. All doors and moveable parts shall be connected to the earth bus with flexible copper connections. Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends. All non-current carrying metallic parts of the switchboard shall be earthed. Earth bus shall be brought back to cable compartments and earthing bolts shall be provided to ground cable armors.

20.4 NAME PLATE:

Nameplates of approved design shall be provided at the top of the panel to represent switchgear designation. A separate nameplate giving details shall be provided at front and rear end of each panel also. Special warning plates shall be provided on all removal covers or doors giving access to high voltage cable terminations/ bus bars. Special warning label shall be provided inside the panels also wherever considered necessary. A name plate with the switch gear designation shall be fixed at the top of the control panel. A separate name plate giving feeder details shall be provided for each compartment. A separate name plate giving details of bus section shall also be provided for switch gears having more than one bus sections.

Engraved name plate shall be provided for each equipment (lamps, push buttons, switches, relays, auxiliary contactors etc.,) mounted on the switch board. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram. Engraved name plates shall preferably be of 3-ply (Black-White Black) lamicoid sheets or anodized aluminium. Name plates shall be fastened by screws and not by adhesives. Switch positions shall be fully identified. Wording shall be clear, concise and unambiguous. Each label shall be permanently secured to the panel surface below the item to which it refers.

20.5 INSTRUMENT TRANSFORMERS:

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Current Transformer (CTs) and Potential Transformers (PTs) shall be cast resin insulated. Primary and secondary terminals shall be marked with good quality PVC stickers.

CURRENT TRANSFORMERS

Current Transformers shall generally conform to IS – 2705. They shall be mounted on the switchgear stationary part. The CT shall be of suitable rating & burden required for individual feeders. The neutral side of the current transformers shall normally be earthed through a 'link'. Unused CT secondary terminals shall be short-circuited with the shorting link. Fault level for CT's shall be considered as 18.3 KA. All CTs shall be capable of withstanding the minimum primary fault current as per the respective breaker capacities.

POTENTIAL TRANSFORMERS

Potential transformers shall be draw-out type and provided with primary and secondary fuses. The potential transformer shall be mounted on a draw-out carriage complete with fuses. The primary connection shall be disconnected before PT or its primary fuses become accessible.

20.6 MEASURING INSTRUMENTS:

All measuring instruments shall be Digital with LED display and of square pattern 96 mm x 96 mm (min.) flush mounted on front-hinged door of instrument compartment of a panel (As specified in the BOQ). All auxiliary equipment such as shunt, CTs, PTs etc. that are required shall be included in the supply of the switchboard. The instruments shall have an accuracy class of 1.0 as per IS - 1248.

20.7 FUSES

All control fuses shall be of HRC link type conforming to IS – 2208. Rewireable fuses shall not be accepted. All fuses shall be readily accessible for replacement. Fuses shall have operation indicator, which will be visible without removal of fuses from the service from its carrier. Fuses shall generally be mounted on the upper half of the panels.

20.8 PUSH BUTTONS:

The push buttons shall be provided for ON/OFF control. The push button contacts shall be rated for a minimum of 5A at 230V single phase. Push button actuator shall be shrouded with dust tight cover, associated springs and contacts shall be of robust construction.

Push buttons colours shall be as follows:

Stop, Open, Emergency – Red

Start, close – Green

Reset, Test – Yellow / black / white

20.9 INDICATING LAMPS:

All indicating lamps on A.C. supply shall be low power consumption indicating lamps fitted with integral epoxy molded transformer 230 V/ 6V and non-breakable translucent coloured (as specified) covers. The lamp rating shall be 6.0 V and 0.75 Watt.

20.10 PAINTING:

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All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. After preparation of the surface, the switch board shall be powder coated with two coats of final paint. The painting thickness shall not be less than 60 microns. Colour shade of final paint shall be as per manufacturer standard. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, runoff paint etc. The inside surface of all switch boards shall be given a coat of fire-retardant paint. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements, then they shall be greased.

21. SAFETY MEASURES

The following points shall be strictly complied with: -

- All electrically operated hand tools shall be of double insulated type.
- All hand tools shall have insulated handle.
- RCCB & MCB to be provided in the construction power distribution network.
- Welding machine shall have proper terminal box for cable termination and earthing.

22. BILL OF QUANTITIES

The quantities mentioned in the bill of quantities are for the guidance of the bidder to quote. The client/consultant do not in any way guarantee that the actual work will exactly correspond to the quantities indicated. It shall be the contractor's responsibility to procure only requisite quantity. The client reserves the right to add/delete any portion of the work within the project site.

SECTION 2 - HT SWITCHGEAR/ RMU

1. This specification covers design, fabrication, testing, packing, and supply of 11 KV (outdoor), free standing, draw-out type metal clad switchboard incorporating vacuum circuit breaker. Reliability of equipment and ease of maintenance without hazards to operation and maintenance personnel are of utmost importance. The equipment shall be capable of continuous and reliable trouble-free operation at full load ratings. The design and construction of vacuum circuit breakers, bus bars and other components shall meet the requirements of severe fault levels. Protective devices and control components shall meet the standard design and the system requirements. The design and construction shall be capable of withstanding the severest stress likely to occur in actual service and of resisting rough handling during shipment. The boards shall be fitted with the same family of vacuum circuit breakers and other components of various rating with a view to ensure uniformity of design and ease in maintenance and replacement of spares. The fabrication and arrangement of the switchboard shall be such that it can be extended on both sides at a future date.

2. CODS AND STANDARDS:

The Switchboard shall conform to latest editions of the following Indian Standards:

a)	IS: 13118	Alternating current circuit breakers.
b)	IS : 4710	Switches and switch isolators above 1.0 kV but not exceeding 11 kV.

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c)	IS : 370	Marking and arrangement of switchgear bus bars
d)	IS : 2705 (P-I T IV)	Current transformers
e)	IS : 3156	Voltage transformers
f)	IS : 1248	Electrical indicating instruments
g)	IS : 2208	HRC cartridge Fuse link up to 650 V
h)	IS : 694	PVC insulated power cables (for voltage up to 1100 V) with copper conductors.
i)	IS : 3427	Degree of protection provided for metal enclosed switchgear and control gear.
j)	IS : 3231	Electrical relays for power system protection.
k)	IS : 6875	Control switches and push buttons.
l)	IS : 5578	Guide for marking of insulated conductors.
m)	IS : 772	Integrated meters
n)	IS : 5082	Materials for data for aluminium bus bars
o)	IS : 3618	Phosphate treatment of iron and steel for protection against corrosion.
p)	IS : 6005	Code of practice of phosphating of iron and steel.
q)	IEC : 56	High voltage alternating circuit breakers
r)	IEC : 298	AC metal enclosed switchgear and control gear for rated voltage above 1 kV upto 52 kV.

3. SYSTEM:

The Switchboards shall be suitable for the following system:

a)	Rated voltage	11/22/33 KV as Specified in $\pm 12.5\%$,
b)	Bus bars	Adequate capacity Electrolytic grade Copper bus bars with uniform cross section, Heat shrinkable sleeved and colour coded.
c)	Operating frequency	50 Hz $\pm 3\%$
d)	No. Of phases	3

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e)	Control and auxiliary supply	24V DC for Control & Protection and 230 V single Phase for space heater, spring charge motor etc. Control supply shall be fed from Self powered Pow Pack unit separately required for the panel (in the scope of supply of contractor).
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4. **COMMON STANDARDS AND MECHANICAL DATA- RMU EXTENTION UNIT**

Metal Enclosed switchgear:	IEC 62271-200
General Purpose switches:	IEC 60265-1
Disconnectors and Earthing switches:	IEC 62271-102
Circuit Breakers:	IEC 62271-100
Common clauses:	IEC 60694
Pressure of SF6 gas:	1.4 bar at 20 °C
Cable bushings:	DIN 47636
Temperature class:	-25 °C - +40 °C OUTDOOR
Degree of protection:	
- SF6 tank:	IP 67
- Front cover:	IP 2X
- Cable cover:	IP 3X
- Enclosure	IP 54
Busbars:	200 mm² Copper
Make of Vacuum interrupter	ABB India Ltd
Earth bar (external):	120 mm² Cu - Bolt dimension: M10
Thickness of Stainless-Steel Tank:	2 /2.5 mm SS304
Thickness of CRCA Enclosure	1.6 mm CRCA
Access to cable	Front cable access
Colours/Paint: 60 to 80 microns	
- Front cover:	RAL 7035/7043
- Cable cover:	RAL 7035/7043
- Enclosure	RAL 7043

5. **ELECTRICAL DATA – 12 kV - 28kV-1min**

Nominal voltage: 11 kV
Rated frequency: 50 Hz
Rated current busbars: 630 A
Rated current cable switch disconnector: 630 A
Short time withstands current:
- Cable switch disconnector with interface C (400-bolt) bushing: 21 kA rms 3 sec.

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- Vacuum circuit breaker with interface C (400-bolt) bushing: 21 kA rms 3 sec.
Rated current for transformer T-off: 630 A
Impulse withstands voltage:
To earth and between phases: 95 kV
Insulation level:
- Power frequency 1 min: 28 kV

Safe Plus- SafeRing Compact Switchgear RMU Configuration (compatible to the existing RMU):

Product ID/ Hierarchy	Description	Qty
SRSP -	12kV, 630A, 21kA-3sec, One Way, Extensible, Outdoor Type IP54 SF6 Gas Insulated Ring Main Unit with One (1) Motorized Vacuum Circuit Breaker (Configuration: +V+ Safe Ring Safe Plus)	01

6. Bill of material for VCB- Vacuum Circuit Breaker - V01

Safe Plus V is a Vacuum circuit breaker module with vacuum circuit breaker, three position isolator/earthing switch, busbars, interlocking, earth bar and stored spring energy mechanism

Qty	Item Description
1	Safe plus type V: Vacuum circuit breaker 12kV, 630A.
1	Stored energy mechanism for motorized operation with ON-OFF PB
1	Integrated manually operated disconnect switch (DS)
1	Integrated manually operated earth switch making fault type (ES)
	Aux NO-NC Contacts VCB: 3NO+2NC, DS: 1NO+1NC, ES: 1NO+1NC
1	Cable cover standard with Interlocking.
3	Cable bushings interface C (400 bolted), 630 A, site replaceable Cable size up to: 300Sqmm 3Cx1R
1	Cable support bar for single run termination
1	Capacitive voltage indication fixed type VPIS 9-15 kV
3	Terminal protector Raychem make
1	Self-powered Numerical protection relay for 50/51/50N/51N Rs485 Modbus Make: C&S CSDPR-V2-300 Or ASHIDA ADR241S
1	Series trip coil for relay
3	Protection CT 100-50/1 A, 2.5VA, 5P10

Additional equipment delivered separately or mounted in respective RMU.

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Qty	Item Description
1	Operating handle
1	Coupling accessories with Terminal protector

Note: The necessary materials required for the completion of the work will be under contractor's scope.

Installation Procedure: Position the VCB Panel on RCC foundation and align properly. Anchor panel using grouting bolts as per manufacturer's foundation template. Connect earthing flats to the station earth grid using two separate earth connections. Terminate incoming and outgoing HT cables with approved heat shrink / cold shrink termination kits. Connect control wiring as per panel wiring diagram. Check mechanical & electrical interlocks of LBS, Earth Switch & VCB. Verify DC power pack output and VCB motor charging operation. All necessary bus bar modifications and additions are included in the work.

Testing & Commissioning: Insulation Resistance Test (5 kV Megger) $\geq 20 \text{ M}\Omega$. Contact Resistance Test as per OEM limits. CT & PT Polarity and Ratio verification. Relay secondary injection tests for overcurrent & earth fault settings. Interlock functional testing between LBS, Earth Switch and VCB. VCB trip & close operation under AC & DC supply conditions. Simulated fault trip & alarm annunciation test.

Safety Requirements: Only licensed HT technicians shall perform installation and switching. LOTO (Lock Out Tag Out) procedure must be followed. HT grade gloves, safety shoes, arc flash PPE mandatory. Danger signage and barricading must be provided during installation & testing.

Documentation to be Submitted: GA Drawing & Cable Termination Layout. Internal Control Wiring Diagram. Routine Test Certificates. Relay Setting Sheet & Logic Diagram. Commissioning Report & Trip Test Records, Technical Data sheet etc.

7. GENERAL REQUIREMENTS (AS REQUIRED):

7.1 The cubicles shall be totally enclosed and vermin proof design. If necessary, opening for natural ventilation shall be provided in the bus bars chamber with uniformly distributed louvers backed up by G.I. wire mesh for protection against entry of insects etc.

7.2 Doors and openings shall be provided with high life cross-linked polyurethane gaskets. All doors shall be key operated & hinged type.

7.3 Switchboards shall be suitable for operating in tropical climate and under the ambient conditions as specified.

7.4 Compartments for cable connections shall be separate and allow cable pulling, termination and connection work with switchgear energized.

7.5 Adequate barrier shall permit personnel to work safely within an empty compartment with the bus bars energized.

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7.6 The design shall be such as to allow extension on both sides. Ends of bus bars shall be suitably drilled for this purpose. Panels at extreme ends shall have openings, which shall be covered with plate screwed at panel.

7.7 The draw-out carriage in the switchboard for all breakers shall have three positions viz., 'Service', 'Test' and 'Draw-out'. Automatic safety shutter shall be provided to ensure the inaccessibility of all live parts after the breaker is drawn out. It shall not be possible to draw-out the carriage with circuit breaker closed. The breaker, shall remain outside the cubicle in the 'drawn-out' position.

7.8 Suitable interlocks shall be provided to prevent faulty operation such as:

- Plugging in' or 'drawing out' of a closed breaker.
- Pulling out of auxiliary circuit plug with breaker in service position.
- Pushing in breaker to service position with auxiliary circuit plug not in position.

8. ACCESSIBILITY

All the components in the Switch board panels shall be mounted in such a way that checking and removal of components shall be possible without disturbing adjacent components. All auxiliary equipment shall be easily accessible and visible from front side with their name plate details. It shall be possible to set all measuring relays 'in situ' without de-energizing the switchboard. All mounted equipment and associated components shall have identification tags of permanent nature at front and at the rear also. Unused C.T. secondary terminals shall be short circuited. All terminals shall be shrouded with plastic covers to prevent accidental contact.

9. DRAW-OUT COMPARTMENTS:

All circuit breaker shall be fully draw-out type. The connections on the bus side, outgoing and control circuits shall be through draw-out contacts so that the breaker can be drawn out without disturbing any wiring. The current transformers for the metering and protection circuits shall preferably be mounted on the fixed portion of the circuit breakers. The circuit breaker mobile portion shall get earthed automatically as soon as the same is inserted into the fixed compartment, irrespective of its position in the compartment. The compartment door shall be interlocked against opening when the breaker is in 'ON' position. It shall not be possible to rack in or draw-out a breaker in service position when the same is in closed position.

10. POWER CONNECTION

The outgoing power connections shall be through XLPE insulated aluminium conductor cables of suitable size. Ample space for connection of cables Cupal Bi-metallic washers shall be used for all copper to aluminium joints. The switchboard shall be supplied complete with supports for clamping outgoing and incoming cables. Terminal blocks shall not be used to support cables.

11. POWER CIRCUIT BREAKER (VACUUM CIRCUIT BREAKER):

11.1. Power circuit breaker shall be 3/4 pole, vacuum type, spring closed, horizontal draw out & horizontal isolation type breaker rated 11 KV and equipped with auto spring charging motor and closing coil working on suitable voltage. It shall be possible to charge

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the spring manually, if required. The breaker draw-out carriage shall be so designed and constructed as to permit the smooth withdrawal and insertion of the breaker into it. The movement shall be free of jerks and easy to operate.

11.2. The interrupter shall be leak free with target value of vacuum life as 20 years.

11.3 'ON' and 'OFF' switches/ push buttons shall be mounted on the front door of each panel so as to operate the breaker manually or electrically. The closing time and tripping time of breaker shall be independent of the speed of the operating handle.

11.4 The breaker shall be provided with an auxiliary relay to achieve the anti-pumping function. This is to ensure that when closing on a fault, it does not reclose after tripping even if the closing input is maintained.

11.5. If the breaker is in closed position, a closing operation of an initiating control device shall not result in further operation of the breaker closing mechanism.

11.6 The breaker shall have following interlocking mechanism.

- i) Breaker can be operated electrically only when it is either in service or in test position.
- ii) Withdrawal of breaker from operating position is possible only when the breaker is in OFF position. Also the breaker cannot be inserted in ON position.
- iii) In the operating position the breaker shall be securely housed and locked. It can be withdrawn or inserted only with appropriate operation of the interlocking levers.

11.7 The breaker position shall be indicated mechanically and electrically. The electrical indications color shall be as mentioned above. It shall be possible to read the breaker position in case each, suitable tags shall be attached for mechanical indication of following:

- i) Breaker ON or closed
- ii) Breaker OFF or open
- iii) Spring charged / discharge.
- iv) Breaker in service position.
- v) Breaker in test position.
- vi) Breaker in draw out or isolated position.

11.8. Vacuum circuit breaker shall be provided with sufficient auxiliary contacts. For requirements of extra space contacts an auxiliary contactor shall be used to multiply the auxiliary contacts of the breakers. All the contacts shall be wired to the terminal blocks and shall be so located as to allow free access. The control circuit shall be suitable for local as well as remote control. Auxiliary contacts and limit switches shall be in dust tight enclosures.

11.9 Mechanical trip push buttons shall be provided for all breakers for emergency tripping.

12. TRIVECTOR METER (SPACE PROVISION ONLY – IF REQUIRED BY KSEB)

Space provision shall be provided for the trivector meter.

13. AUXILIARY EQUIPMENT:

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Auxiliary relays / contractors shall generally be used for interlocking & multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum estimated current. In any case their rating must not be less than 5 A for 240 V AC.

14. The protection/tripping and numerical relays shall be provided as per KSEBL/CEA norms.

15. INSPECTION & TESTING

Fully assembled switchboard shall be subjected to inspection by owner and by an agency authorized by the owner at the manufacturer's works if required. The inspection call notice shall be given at least 3 (three) weeks before the date of inspection.

15.1 Routine test shall be carried out at manufacturer's works under his care and expense. All routine tests as per IS 13118 (1993) shall be carried out at the manufacturer's works.

15.2 Acceptance test shall be carried out as follows:

- i) A general visual check shall be carried out. This shall cover measurement of overall dimensions, locations, number and type of devices, terminal boxes, location and connection of terminals etc.
- ii) Manual & electrical operation of circuit breaker shall be checked under the worst conditions of auxiliary supply voltage.
- iii) Dry insulation test with power frequency voltage shall be conducted for the main and auxiliary circuits shall be checked.
- iv) Insulation resistance of the main and auxiliary circuits shall be checked.
- v) Operation check shall be carried out for every control function as per the approved schematic diagrams by manually simulating fault conditions and operation of control switches/ relays etc.

15.3 For equipment bought from other sub-suppliers certified test reports of test carried out at the manufacturer's works shall be submitted. The sub-suppliers at his works shall conduct all routine test as specified in the relevant standards.

16. DRAWINGS & DOCUMENTATION

The supplier shall develop his own general arrangement and schematic drawing adding necessary auxiliary devices, accessories, components peculiar to supplied equipment etc. which are required for safe, convenient, efficient and proper operation of the HT switchgear.

The following drawings of the offered switchboards shall be submitted for owner's approval:

1. G.A. drawing.
2. Complete single line diagram/ control wiring.
3. Complete bill of material including makes of components etc.
4. Technical data sheet.
5. Bus bar correctional drawings.
6. Any other drawing requested by the customer at the time of drawing approval.

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The Owner's approval of the drawings shall not relieve the supplier of his responsibility for supplying equipment conforming with the relevant specifications and standards or of any mistakes, errors or omissions in the drawing. The supplier shall submit three sets of the approved drawings along with one set of reproducible at the time of effecting delivery. The supplier shall submit maintenance and operation manual at the time of effecting delivery. One set of the same shall be submitted along with the inspection report.

17. TESTS:

The following preliminary checks and pre-commissioning tests shall be carried out before commissioning the Switchgears in the presence of Buyers/Architect's representatives.

Preliminary Checks:

Check name plate details according to specification. Check for physical damage.

Check tightness of all bolts, clamps and connecting terminals. Check earth connection.

Check cleanliness of insulators and bushings, arc chambers. Check all moving parts are properly cleaned and lubricated. Check space heaters provided.

17.1 PRECOMMISSIONING CHECKS:

- Check alignment of breaker trucks for free movement. Check correct operation of shutters. Slow closing/opening operation.
- Check control wiring for correctness of connections, continuity and IR values.
- Manual operation of breakers.
- Power closing/opening operation manually and electrically.
- Breaker closing and anti-pumping operation.
- Breaker local / remote opening closing.
- Minimum pick up voltage of coils.
- Check electrical and mechanical interlocks provided.
- Check on spring charging motor correct operation of limit switches and time of charging. Check on CT's / PT's Polarity / ratio.
- All functional checks with the relays, meters, alarm scheme, interlock as per scheme with primary / secondary injection kits.

Note: The panel shall be as per KSEBL/CEIG/CEA standards. The responsibility of obtaining drawings & panel approval from KSEBL/CEIG/CEA shall be in the scope of electrical vendor.

18. LIAISON WORKS.

Liaison with the CEA/CEIG/ KSEBL for preparation of Working drawings etc., obtaining approval for drawing, Energization approval for the entire electrical works and DGs also. The contractor shall obtain statutory approval from the Electrical Inspectorate/CEA and KSEBL prior to energization. 3sets AS BUILT drawings and maintenance manuals for major equipment's for entire Electrical installation to be submitted. The following details and rates for the same are to be considered by the contractor.

- a. Coordination and corrections to be made - scheme approval if required from CEIG/CEA
- b. Arrange – CEIG/CEA inspection and getting sanction order for energization.

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Liaison with Electricity Authorities of Kerala (KSEBL)/CEA including submission of Application Forms and other associated works, follow up with them and effecting power supply. All incidental charges shall be included in the rate and only official payment will be made against original receipts.

The following works are included in the scope

- a. Application for power allocation at electricity board.
- b. Earth- soil resistivity test.
- c. Submit the application to electricity board
- d. Completion certificate submission
- e. KSEBL inspection and coordination's
- f. Relay, Meter and instruments testing and get approval from Consultant/ Client before handover to site
- g. EB charging.
- h. Charges for preparation of 3sets AS BUILT drawings and maintenance manuals for major equipment's for entire Electrical installation.

SECTION 3 - UNITISED SUBSTATION & DG

1 SCOPE

This specification covers the technical requirements of design, manufacture, test at works, supply and providing commissioning supervision of Unitized Substation complete with 11KV HT LBS PANEL, Resin cast Dry Type Transformer, LT Isolation panel with provision for connecting the LT cables to the MV panel, and other accessories covered in a compact single Weather proof enclosure, for Safe, Efficient and Trouble-free operation.

2 STANDARDS

The equipment covered by this specification shall, unless otherwise stated, be designed, constructed and tested in accordance with the latest revisions /Amendments of relevant Indian Standards.

IEC 62271 200 & 100	-	Indoor /Outdoor Installation
IS: 13118	-	Circuit Breaker
IS: 3427	-	Metal Enclosed Switchgear and Control Gear for voltage above 1000V but not exceeding 11000V.
IS: 3231	-	Electrical relays for power system protection.
IS: 2705	-	Current transformer
IS: 3156	-	Voltage transformer
IS: 375	-	Marking and arrangement for switchgear busbar main connections and auxiliary wiring.
IS: 1248	-	Direct acting electrical indicating instruments.
IS: 6875	-	Control Switches for voltage up to and including 1000V AC and 1200V DC.
IS: 722	-	AC Electricity Meters.
IS :2147	-	Degree of Protection provided by enclosures.
IS :8623 (Part II)	-	Particular Requirements for Bus Trunking System.

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IS :13947	-	Specification of Low Voltage Switchgear and Control gear.
IS: 732	-	Code of practice for Electrical wiring installation.
IS: 2959	-	AC Contactors for voltage not exceeding 1000V.
BS:162	-	Specification for Electric Power Switchgear and Associated apparatus.

3. **GENERAL REQUIREMENTS**

The Unitised Substation shall consist of the following.

- a. 11KV HT Single LBS panel.
- b. 500KVA, 11KV / 433V Resin cast Dry type Transformer
- c. LT Cable Termination box for outgoing feeder.

High Level of personnel safety, ease of operation and aesthetics need to be taken care while designing the enclosure and laying out the equipment within the enclosure.

The enclosure housing all the components of the Unitised Substation shall protect these components against unauthorized access and environmental Hazards. The enclosure and the equipment arrangement shall be such that, adequate ventilation is available for natural cooling of the Electrical Equipment. Also all the live parts in the Unitised Substation shall be protected against unintentional contact by means of Lockable Doors. Door interlocks using Limit Switch shall be provided in a way that the terminals of the transformer are not accessible when the Transformer is live. Lighting shall be provided on both HT & LT sides for maintenance, and interlocked with the doors such that the respective lamp goes ON when the doors are opened. The entire Unitised Substation shall be mounted on a common Base frame. The Roof of the enclosure shall be sloped to avoid from Rain Water collection.

4. **500KVA Unitised Substation – Specification**

Design, manufacture, supply, installation testing of 500 kVA Indoor Type Unitised Substation (USS) suitable for KSEBL 11 kV, 11KV/433V, 3 phase, vector DYN-11, Copper wound, Cast resin transformer with off circuit tapping's from +5% to -10% in steps of 2.5%, changeable on off circuit by tap links provided, with WTI & LV terminals suitable for LT CT and TOD Meter Provision 3 runs of PVCA cable and HV terminals connected to 11 KV, 26.2 KA, 630 A Load Break Switch, with incoming suitable for XLPE cable, with HT HRC fuses and output connected to 11KV seal off bushings to the transformer. Solidly earthed neutral system, conforming to relevant IS / IEC standards, complete in all respects, comprising of:

(a) 11 kV Indoor HT LBS Panel -

1No. 630A, 11KV, 26.3kA for 1 sec., Air break manual front operated Load break switch with earth switch, tripping coil rated for 230V AC, both interlocked complete with shunt trip coil, 1No. Earth fault relay Trip circuit & with Trip Push Buttons (Mechanical and electrical) & wiring. AL/cu Bus Bar, interconnections, and supports.

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(b) 500 kVA, 11/0.433 kV Indoor Type Dry-Type Distribution Transformer -

Type-Cast Resin,

Double Wound, Core Type, Winding Material -Copper,

Rating -500kVA, Voltage Ratio-11kV/433V, Rated Frequency -50 Hz,

No. of Phases (HV)- Three, No. of Phases (LV) -Three,

Type of Cooling -AN, Vector Group -Dyn11,

Voltage between Phases - a. HV 11000V, b. LV 433V,

Connection on HV Side -DELTA, Connection on LV Side -STAR,

Type of Terminals – a). HV side connected to LBS, b). LV side connected to Cable Box

Whether Neutral brought out on LV Side- Yes,

Tapping on HV Side +5% to -10% in steps of 2.5% changeable by off circuit tap links.

Temperature Rise at Ambient Temperature.

a. Winding by Resistance 100° C,

Impedance at normal Voltage Ratio at 75°C 5% with IS Tolerance,

Type of Installation- Indoor,

Type of Insulation -CLASS F,

Maximum Guaranteed Losses at 75°C,

a. Total Loss at 100% Load 7250 Watts (max) with IS Tolerance

b. Total Loss at 50% Load 2200 Watts (max) with IS Tolerance,

Details of Core CRGO as per IS 3024/2015,

Impulse Voltage Withstand at HV side 75 kV (P),

Power Frequency Withstand Voltage - HV Side 28 kV (rms), LV Side 3 kV (rms)

(Provision for fixing TOD meter in the secondary)

(c) Common unitised base frame / structure -

For mounting HT LBS panel, transformer and LT TOD meter with proper segregation, alignment, Lifting arrangement and internal interconnections, factory assembled and tested; complete with Routine tests, inspection, packing, delivery at site and approval from KSEBL / CEIG/CEA.

Installation, testing and commissioning of 500 kVA Indoor Unitised Substation (USS) comprising 11 kV HT LBS panel, 500 kVA Dry Type Distribution Transformer (DTR), including unloading, shifting, positioning, alignment and fixing on prepared RCC foundation / floor; HT side works such as termination of 11 kV HT cables with approved heat-shrink / cold-shrink kits, interconnection between HT VCB panel and transformer HV side; LT side works including interconnection between transformer LV terminals and LT ACB / USS panel, termination of LT cables / bus links; complete earthing connections for HT panel, transformer body, transformer neutral and LT panel to existing earth grid; control, protection and metering wiring as per approved schematics; testing & pre-commissioning including insulation resistance tests, contact resistance test, CT/PT polarity and ratio tests, protection relay secondary injection tests (OC & EF), interlock checks, VCB trip & close operation under AC & DC supply, transformer tests (IR, tap position where applicable), LT panel

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functional and protection tests; final commissioning, energisation, coordination with KSEBL, assistance during CEIG / KSEBL/CEA inspection, submission of test reports and handing over, complete in all respects as per KSEBL / CEIG/CEA norms.

4.1 **Current Rating**

Every current carrying part of the equipment, including Load Break Switches, Circuit Breakers, Current Transformers, Isolating Switches, Busbars, connectors and joints shall be capable of carrying its rated current continuously and in no part shall the permissible temperature rise be exceeded.

In addition, all parts of the switchgear, including current transformers, shall be capable of withstanding the instantaneous peak and the three second short time currents corresponding to the rated making and breaking capacity of the circuit breaker, without thermal or mechanical damage.

4.2 **Voltage and Frequency Variations**

Transformer shall operate without injurious heating on any Tap under the rated KVA at any voltage within $\pm 10\%$ of the rated voltage.

4.3 **Rated Power and Temperature Rise**

The transformer shall be capable of operating at rated power, specified in the technical schedule, on a continuous basis and with the cooling classification given at the most onerous simultaneous climatic conditions specified. The temperature rise specified shall not be exceeded when the transformer is operated continuously at the rated power at the design ambient temperature of 45° C.

4.4 **Rated Voltage and Tapping**

The principal tapping rated voltage shall be as specified. The tapings shall provide a variation in the Transformation ratio without producing phase displacement. All tapings shall be full power tapings.

4.5 **Impedance Voltage and Short Circuit Impedance**

The impedance voltage at principal tapings shall be as specified.

4.6 **Short Circuit Withstand Capability**

The transformer shall be designed and constructed to withstand capability of 25KA without damage to the thermal and dynamic effects of external short circuits between phases or between phase and ground.

4.7 **Insulation Levels**

The insulation shall withstand the rated lightning impulse voltage and power frequency withstand voltages.

4.8 **Radio Interference**

The transformer shall be designed and constructed so as not to cause any undesirable interference in radio, communication and Networking (PCs) Circuits.

5 **Construction Features**

General

Screws, studs, nuts and bolts shall be hot dip galvanized or of stainless steel or brass as appropriate.

5.1 Core

The core shall be built up, interleaved with high grade, non-ageing, low loss, high permeability,

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cold rolled grain oriented, silicon steel laminations properly treated for core material.

The final core assembly shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibrations during operation. The frame, clamps and core bolts shall be electrically insulated from the core. Such insulation shall be capable of withstanding maximum temperature existing in the core. For this purpose, Class B or better insulation shall be used. The core and windings shall be suitably braced to prevent displacement or distortion during transportation or abnormal electrical conditions in service. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. All metal parts of the transformer core assembly except individual core laminations, core bolts and side-clamping plates shall be earthed.

5.2 Windings

The coils shall be of electrical grade high conductivity copper conductor, properly insulated and stacked. Coil assembly shall be suitably supported between adjacent sections by insulating spacers and barriers which shall be permanently secured in place. Windings shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. Coils shall be so insulated that the effect of impulse and power frequency voltage stresses are minimum. The transformer winding shall be connected in group of vector symbols specified.

5.3 Tap changing link

The tap changing link shall be provided on the H.V. windings for a variation of no-load voltage as specified.

5.4 BUSBARS AND CONNECTIONS

Busbars and connections shall comply with applicable clauses of IS: 5082. The busbars and connections shall be made of high conductivity copper/ Al. The busbars shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding the total temperature of 85 deg C. The busbars and their connections shall be capable of withstanding, without damage, the thermal and mechanical effects of a through fault current equivalent to the short time rating of the switchgear. Busbars shall be of uniform cross-sectional area throughout their length with connections as short and straight as possible. The resistance of any length shall not be greater than an equal length of similar section conductor, without a joint. Busbars shall be contained in a separate compartment within the general casing of the switchgear. Access to busbars and the connections directly thereto shall be gained only by the removal of covers secured by bolts or screws. Phase colours shall be red-yellow-blue and colour sleeves shall be provided at regular intervals.

5.5 EARTHING

All metal parts, other than those forming part of an electrical circuit, shall be connected to a hard drawn, high conductivity, suitable size of GI or equivalent copper earth conductor on each unit as specified in the drawing. It shall be bolted to the main frame and shall be located so as to provide

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convenient facilities for earthing cable sheaths and for use with earthing devices. Particular care should be taken to ensure that the truck of draw-out circuit breakers shall be connected to the earth bar through a plug type contact and the plug shall be long enough to allow the busbar and feeder shutters to close before breaking contact. Current transformer and voltage transformer secondary circuits shall be earthed at one point only. The panel shall be provided with two earthing stud terminals with suitable nuts, washers etc., for connection to Earthing Grid. The Transformer Neutral shall be connected to separate earthing through a suitable size of copper busbar mounted on insulating bushings and ultimately connected to dedicated earthing.

5.6 INSULATORS

Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index. Provisions shall be made to accommodate expansion and contraction of the connection, to take care the temperature rise likely to be attained during fault conditions.

5.7 CURRENT TRANSFORMERS

The current transformers shall have synthetic resin insulation and be of the single-phase type, with separate core for metering and separate core for protection.

The primary and secondary connections shall be clearly labeled.

The cores for measuring purposes shall have

Accuracy Class 1 or as specified in the drawing.

Instrument Security factor < 5

The cores for protection purposes shall have:

Accuracy	Class 5P
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Accuracy limit factor > 10

The burdens of all cores shall be as specified.

All current transformers shall be dimensioned to carry continuously a current of 120% of the rated current. The rated secondary winding current shall be 1A.

5.8 VOLTAGE TRANSFORMERS

The voltage transformers shall be of synthetic resin insulation and be of the single phase type. Rated secondary voltage shall be 110 V/ $\sqrt{3}$. All primary and secondary connections shall be clearly marked.

The secondary windings shall have accuracy Class 1.0. The burden of all windings shall be as specified.

5.9 DRAWINGS AND MANUALS

All relevant Drawings / Documents / Manuals shall be submitted in three copies for Approval by Client / Consultant. As built drawings, both in soft form and 3 hard copies may be submitted along with the delivery document.

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5.10 **TEST**

5.10.1 **Factory Tests**

Complete test shall be made at the manufacturer's plant to determine the performance and operating characteristics of the various components of the Unitised Substation (in enclosure), and accessories to determine whether or not the guarantees have been met. Unless otherwise specified, all tests shall be carried out in accordance with the standards and shall include

5.10.2 **Routine Tests**

- a. Resistance measurement of all windings on the rated voltage connection and on all taps.
- b. Ratio tests on the rated voltage connection and on all taps.
- c. Polarity and phase rotation tests.
- d. Impedance and load loss at rated current on the rated voltage connection and on all the taps.
- e. No-load loss and current at rated voltage on the rated voltage connection and at 95, 110 and 115% of rated voltage.
- f. Power frequency withstand test.
- g. Insulation resistance tests.
- h. Mechanical operation test
- j. Dielectric tests

5.10.3 **Type Tests**

The Vendor shall furnish two (2) copies of the following type test certificates conducted on similar Unitized Substation.

- a. Temperature rise test for the Transformer.
- b. Zero phase sequence test at all taps of the Transformer.
- c. Audible sound level test for the Transformer.
- d. Short time current test.
- e. Temperature rise test
- f. One minute power frequency voltage withstand test.

5.11 **COMMISSIONING ASSISTANCE**

Commissioning Engineer shall be available at Site in order to ensure that the installation is in order before commissioning the Unitized substation. Advance intimation would be provided before commissioning the Transformer in order to enable his availability.

DIESEL GENERATOR AND ALLIED WORKS

1. SCOPE OF WORK

Supply, installation, testing and commissioning of the Diesel Generators and its allied works as mentioned below.

- Supply and installation of 3 PHASE 415volts, 1No x 125KVA

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- Supply and installation of Auto On/Off panel (ATS) connecting all the above.

The proposed Diesel Generating sets and connected works shall be carried out in accordance with their Specification and associated Drawings, and without abrogating the more extensive details described elsewhere in the Specification and Drawings.

2. REGULATIONS AND STANDARDS

- (a) The standards, codes, and specifications referenced below and elsewhere in their Specification shall be of the latest editions.
- (b) Similar codes or standards used in the home country of the manufacturer may, however, be used if applicable, subject to the acceptance of the appropriate local Government authorities. In such case it shall be the responsibility of the manufacturer to prove to the satisfaction of the Project Manager that such codes are essentially equal to the one specified.
- (c) Unless otherwise specified, the Diesel Generators & its Allied Equipments Installation shall comply with the latest editions from time to time of the following documents:
- (d) Type test or certification of electrical equipment as specified in the Specification herein shall be carried out by the institutions listed here below unless otherwise approved by the Project Manager:

- ASTA : The Association of short-circuiting Testing Authorities
- BASEC: British Approvals for Electric Cables
- NEMA : National Electrical Manufacturer's Association
- CPRI : Central power Research Institute
- CEIG: Chief Electrical Inspector to Government
- KPCB: Kerala Pollution Control Board.
- CEA : Central electricity authority.

- (e) No substitutions to these standards shall be allowed without the endorsement of the Project Manager.
- (f) It is the Contractor's responsibility to ensure that the various authorities are satisfied with the codes adopted by the Contractor in these works.
- (g) Wherever there are conflicts between different codes above, the more stringent code shall apply.
- (h) Under no circumstances shall materials contain asbestos based materials.

3. DRAWINGS & DOCUMENTS

Prior to commencement of installation, the Contractor shall submit for the Project Manager's approval shop drawings which shall include the following.

- General arrangement drawings, supporting details, shipping details, installation manuals etc. for equipment's and confirm the adequacy of space requirements.
- Catalogues and Data sheets of standard items.
- Design calculations wherever required by the Project Manager such as Diesel Generator, Exhaust pipes etc.

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The shop drawings shall be generally in accordance with the drawings supplied with their specification and updated by the Project Manager's Instruction for Variation. The Contractor shall provide the layout drawings detailing Builder's work and confirming structural dimensions.

DETAILED TECHNICAL SPECIFICATION

1. SCOPE

- 1.1. The speed of proposed DG sets not exceeding 1500 RPM, engine, designed for operating on high speed diesel, 415V Diesel Generator sets consisting of air-cooled engine alternator and engine mounted radiator suitable for ATS START/STOP, and auto load sharing along with all accessories and components such as chimney, ventilation system, fuel system etc. at vendor and / or their sub-vendors works, supply, transport and delivery to site including, insurance, handling, unloading and safe keeping etc. at site complete erection and installation on foundation prepared by another agency, connecting to all completed accessories and components and integrating the performance of all sub-systems, testing and commissioning and performance testing, maintenance of entire installation of the plant system including all connected structural, electrical and minor civil works required for the proper and efficient functioning of DG sets as specified in Specification / Bill of Quantities and Drawings.
- 1.2 Design, Supply, installation, testing and commissioning of silencer Exhaust pipes with insulation, chimneys as required etc.
- 1.3 Design, Supply, installation, testing and commissioning of earthing arrangements.
- 1.4 Design, Supply installation, testing and commissioning of necessary heavy duty anti-vibration spring type mounts suitable for the DG sets with necessary bolts etc. for satisfactory installation.
- 1.5 Design, Supply, installation, testing and commissioning of fuel pipe lines from day tank with necessary pumps, valves etc. as per the drawing enclosed.
- 1.6 Design and preparation of the drawings for exhaust lines; provision of sampling ports for all types of stacks, submission and obtaining approval and necessary certificate from Pollution Control Board and other statutory authorities.
- 1.7 Design and preparation of the drawing for statutory authorities such as Pollution Control Board etc. for commissioning the system including arranging inspection and also necessary approval / safety certificate from authorities etc.
- 1.8 Design and preparation of electrical drawings for generator and connected electrical installation work submission, obtaining approval to drawings arranging inspection,

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obtaining supply certificate from Electrical Inspectorate/CEA, Government and other statutory authorities.

- 1.9 The client will render necessary assistance to the successful tenderer in the form of furnishing letters and documents for obtaining such approvals. But the responsibility for obtaining approvals including arrangements for inspections etc. is that of the tenderer.
- 1.10 Design, manufacture, supply, installation, testing and commissioning of water / fuel line 'B' class G.I. pipe with necessary coupling valves, taps etc. for radiator cooling.
- 1.11 The scope of package for DG set tender shall include the tenderer to design, fabricate, supply, install, test, commission, hand over and maintain, during the guarantee period all required accessories and components that are required for a fully functional power generating station. Such accessories and components shall include all the following but not limited to:
 - a). Exhaust pipe line to suitable heights conforming to the statutory regulations by Environment Authorities. The height of the exhaust line shall be terminated up to terrace slab level. The Exhaust line shall be self-supporting type and shall include necessary holding down bolt arrangements.
 - b). The Owner / Architect/ Consultant reserves the right to scrutinize and call for any modifications in the design of any components, if required such change in design is handled to meet the Owner's requirements as well as statutory requirements. In such a case, tenderers shall be required to incorporate the changes without any claim to extra.
 - c). Vibration Isolation Mounts – All generators shall be resting on foundations, which will be constructed by the Main Contractor. All necessary Design, data to be furnished by the tenderer facilitates design and construction of foundation through other agencies. The tenderers shall however include necessary bolts, insert plates, connectors etc. as may be required and supply of such interface components shall fall within the scope of the tenderer. The successful tenderers technical personnel should be available at all time during the execution of connected civil works and certify important construction parameters such as alignment, levels including cut outs etc. If any interrelated civil works have to be carried out for which necessary technical support from successful tenderer is not available in time, any cost incurred by the Owner in rectification / remaking of such interface items will be to the account of successful tenderer for the DG set package.
- 1.12 Battery Limits:
The scope under their Bid covers turnkey DG set installation including all accessories and components. The supply and laying of cable between DG isolation panel to DG MAIN panel shall also be in Electrical contractor scope, But all holding down bolts, insert plates, embedment's etc. shall be supplied by the DG contractor. The foundation design shall also be within the scope of the DG contractor, which shall be got approved from Owner / Architects before execution.

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- 1.13 The required exhaust pipe upto the terrace floor with relevant cladding and MS support arrangement for fixing the Exhaust pipe from the DG set up to terrace shall be considered. The quoted rate here should consist of relevant Bird mesh at the top end of the Exhaust pipe at terrace or wherever it ends. Engine mounted Instrument Panel fitted with and having digital display for following:

- (i) Start- Stop switch
- (ii) Water Temperature indication
- (iii) Lubrication oil pressure indication
- (iv) Lubrication oil temperature indication
- (v) Battery charging indication
- (vi) RPM Indication
- (vii) Over speed indication
- (viii) Low lub. Oil trip indication.
- (ix) Engine Hours indication

2 GENERAL SPECIFICATIONS FOR DIESEL GENERATOR

The diesel generator set shall consist of diesel engine coupled to alternator having self-brushless excitation system and including all necessary accessories and the control panel. The engine and alternator shall be mounted on the single robust fabricated steel frame. Required set of anti-vibration pads should be supplied.

3 CODES AND STANDARDS FOR DIESEL ENGINE

The Diesel Generator set with all its components shall comply with latest applicable standards, regulations and safety codes in the locality where their equipment will be installed. The equipment shall conform to the following standards with latest additions. The DG set shall be tested as per ISO 3046.

BS :	5514 or ISO 3046	-	Diesel engines for general purposes.
IS :	10000	-	Method of test for IC engines.
IS :	10002	-	Performance of constant speed compression ignition engines for general purposes.
IS :	1460	-	Specification for diesel fuels.
IS :	4722	-	Rotating Electrical machines.
IS :	4889	-	Method of determining efficiency of rotating electrical machines.
DIN :	6271 or BS : 5514	-	Over load capability.
VDI :	2063	-	Limiting vibration of the engine.

The fuel analysis of HSD shall be taken from IS: 1460 – 1995.

4 GENERAL SPECIFICATION FOR A.C. GENERATOR

Their specification cover the minimum technical requirements for the design, manufacture, testing and supply of self excited, brushless generator with automatic voltage regulator and other accessories as a part of diesel generator set.

5 CODES AND STANDARDS FOR ALTERNATOR

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- 5.1 Alternator shall be designed, manufactured and tested as per currently applicable statutes, regulating and safety codes in the place where the equipment will be installed.5.2
- 5.2 The equipment offered shall conform to the following codes/standards. Unless they are in variance with the clause of their specification, the synchronous generators and their components shall comply with the latest edition of the applicable standards listed below:

BS-2613 :The Electrical Performance of Rotating Electrical Machinery.
 IEC-34-1:Rotating Electrical Machines.
 IS-4722 :Specification for Rotating Electrical Machines
 BS-4999/5000: All applicable parts of BIS-4999 /5000
 IEEE115:Test procedure for synchronous machines.
 VDE 053 :Rotating electrical machine.

- 5.3 Any other recognised international standard may be used in lieu of the above, subject to the approval of the Purchaser.
- 5.4 Alternator shall also conform to the latest editions of standards including all revisions and addenda currently applicable at the time of placement of order.

6. A.C. GENERATOR –1 NO OF 125 kVA DIESEL GENERATOR SET

The alternator offered shall be suitable for the site conditions indicated in the project information data sheet. The generators shall be of Brushless type of capacity 1No of 125KVA 415 volts, 0.8 PF, 3 phase, 50 Hz and should be of single bearing type. The degree of protection shall be IP-23 & method of cooling IC-01

7. VOLTAGE / FREQUENCY VARIATION

The generator shall be capable of satisfactory continuous operation at rated KVA and power factor at any voltage from 90% to 110%. rated voltage and with a frequency range of 47.5 Hz to 51.5 Hz. The transient voltage dip should not exceed 15% for rated load and should be restored within 0.8 Second.

8. AUTOMATIC VOLTAGE REGULATOR (AVR)

The AVR shall control the generator voltage under steady state load conditions and over the whole of the operating range of the exciter within + 1.0% of the setting value without hunting.

The automatic solid state voltage regulator shall be provided with the following features as minimum.

- 1 - Under frequency protection.
- 2 - Short-circuit protection.
- 3 - Voltage build-up circuitry.
- 4 - Over voltage protection
- 5 - Minimum and over excitation protection
- 6 - 2 Nos. AVR with auto change over facility shall be incorporated.
- 7 - Detection of loss of sensing (Trip signal)
- 8 - Diode Failure detection.
- 9 - AVR –1& 2 failure – Alarm Signal & Trip Signal.

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9. OTHER TECHNICAL REQUIREMENTS

The alternator shall be mounted on a common base frame together with prime mover unless otherwise agreed upon. The alternator shall be provided with necessary lifting hooks.

10. PROTECTION

Each generator shall be provided with the following minimum protection. However, other protections as considered necessary by the generator manufacturer shall be included.

1. Voltage controlled over current IDMT protection
2. Over Load – Alarm.
3. Under / over frequency – Alarm.
4. Earth fault IDMT protection
5. Under voltage / over voltage protection.

11. RATING PLATE

A rating plate of corrosion-resistant metal shall be fixed on the generator frame and shall give the following information :

1. - Manufacturer's Name
2. - Serial Number, Type and frame reference.
3. - Rated output in kVA and kW.
4. - Rated power factor
5. - Rated frequency
6. - Rated voltage
7. - Rated stator current
8. - Rated speed in Rev/Min
9. - Class of insulation
10. - Phase rotation (CW or CCW)
11. - Rotor current and voltage at rated output.
12. - Customer's indent number
13. - Year of Manufacturer
14. - Weight of alternator in Kg.

12. TESTS & INSPECTION

1. Detailed test procedures along with the facilities available at vendor's works shall be submitted along with the bid Test certificates including test records and performance shall be furnished by the supplier at the time of delivery.

2. Type Test

The report on type test conducted for 1No of 125 kVA generator as per IS 4722 shall be submitted along with the tender.

Alternator

- a. Open Circuit characteristic test
- b. Short Circuit characteristic test
- c. Temperature rise test

DG Set

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- d. Over load test
- e. Over speed test
- f. Vibration measurement test

The tenderer shall submit authenticated test certificate for the type test carried out by them and if required the Client / Consultant can insist for a type test to be carried out on the Generator in the presence of Client / Consultant.

3. Final Check

General check and test of assembled parts, wiring, labels, connection diagram, rating, heater etc.

13 List of data/drawings to be submitted by the tenderer along with the tender.

The list shall essentially include the following:

1. P & I drawing of the entire system envisaged.
2. Over all dimensions and major parameters of the diesel engine and balance of plant system along with technical literature.
3. List of sub-vendors for major equipment and system.
4. Bar chart and network schedules covering all milestone activities.
5. Technical parameters and other relevant data of all equipment offered.
6. Overall layout.
7. Equipment layout.

14. **TECHNICAL SPECIFICATION FOR DIESEL ENGINE RADIATOR COOLED TYPE**

The diesel engine shall be vertical single acting direct injection type with turbo charged and after cooled. KW rating, auxiliary power consumption, guaranteed fuel consumption, governor performance and tortional vibrations shall be in accordance with ISO : 3046 or BS: 5514. The engine shall be supplied with radiator and blower fan.

The speed of the diesel engine offered shall not exceed 1500 RPM. The engine offered shall be a four (4) stroke engine designed for operating on high speed diesel (HSD). Material / item if any which may found omitted but required to make a complete diesel generator set should be supplied. The diesel engine for 125Kva Diesel Generator set should consist of the following:

AIR INLET SYSTEM

After cooler core, Air cleaner – Dry paper element with Service Indicators, Turbo chargers.

COOLING SYSTEM

Radiator with Upper and Lower connections, Blower fan, belt driven, fan guard, Jacket water pump –centrifugal with metallic impeller.

EXHAUST SYSTEM

Exhaust manifolds, dry, Turbo charger, Exhaust flexible fittings, Exhaust flanges, Exhaust silencer – Residential type.

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FUEL SYSTEM

Fuel injection pump, New scroll type, High pressure, Fuel filter, spin –in type, Fuel transfer pump, Primary fuel filter, Fuel priming pump, Flexible fuel lines, Water separator.

LUB SYSTEM

Lube oil filter, spin-on, Lube oil pump-gear driven with strainer, Lube oil cooler, shell and tube type, Crankcase breather, top mounted, Fumes disposal tube, Oil filter and dipstick, Lubricating oil Lube oil pan with drain plug.

FLYWHEEL & FLYWHEEL HOUSING

Flywheel, SAE-1, Flywheel Housing, SAE-1, SAE standard rotation

CHARGING SYSTEM: Charging alternator 24 V.

CONTROL SYSTEM: Governor, ELECTRONIC type suitable for Synchronizing the sets.

INSTRUMENTATION: The set will be supplied with Microprocessor based Control Panel with the following features.

Automatic / manual start -stop with safety shut downs.

LCD Readouts for:

- Engine Oil Pressure
- Coolant Temperature
- Engine RPM
- System DC Volts
- Engine Running Hours
- Generator AC volts
- Amps and Frequency

LED Indicators for:

- Low Oil Pressure
- High Coolant
- Low Coolant Level
- Over speed, Over crank, Emergency Stop
- Spare Fault Shutdown and Alarm

Adjustable Cycle Cranking, Adjustable cool down timer, Programmable for Energize to Shut Off or Energize to run, Generator Voltage Adjust Potentiometer, Indicator / Display Test Switch, NEMA 1/IP 22 enclosures, Emergency Stop Push - Button

Protective relays:

- Over voltage
- Under voltage
- Over frequency
- Under frequency
- Over current
- Reverse Power

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STARTING SYSTEM

Starter motor, 24 V DC, 24 Volt Batteries of suitable AH capacity, Battery leads and stands
Key switch

GENERAL

Vibration damper, Paint Yellow, Lifting eyes, Warranty certificate, Engine tests certificate
Engine Operation and Maintenance Manual, Engine spare parts manual, Generator O & M
manual, Battery warranty cards

GOVERNING SYSTEM: Microprocessor based fuel system controlled by computer – Class A-1 as per ISO 3046.

GENERAL: The engine should display electronically RPM, cumulative number of hours of operation, fuel consumption data. Engine should be capable of self-diagnostic, diagnostic codes should be displayed on demand for each fault and operation. Display should also indicate the worst parameters for each fault. The engine control panel should give alarm indication with silencer for the faults.

Note: The engine shall be supplied with first fill of lube oil.

GENERATOR & GENERATOR ATTACHMENTS

Alternator, self-regulated, self-excited, screen protected, drip proof, Brushless, two bearing alternator of 125 KVA, 3 Phase, 415 Volts, 50 Hz., @ 1500 RPM with class H insulation and IP 23 enclosure. The alternator will be fitted with Automatic voltage regulator and confirmed to IS: 4722.

BASE FRAME AND COUPLING

Diesel engine and alternator are coupled together with Holset coupling and placed on robust, sturdy iron base frame specially designed to absorb vibrations for the smooth operation of the D.G. set. High efficient Anti vibration mountings will be supplied along with the DG set.

BATTERIES: 24 V / 12 V dry uncharged suitable plates of batteries along with terminated lead connectors including inter connection cables will be supplied. Suitable M. S. make battery stand will be provided.

15. TECHNICAL PARTICULARS FOR 125 KVA DG SET**Diesel Engine**

Type	-	Direct injection
Stroke	-	4
Speed	-	1500 rpm
Fuel	-	As per manufacturer.

Alternator

Rating - Prime	-	125KVA
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Voltage	-	415V
No. of Phase	-	3
No. of Wires	-	4
P.F.	-	0.8
Speed	-	1500 rpm
Short circuit withstand capacity	-	300% for 10 sec.
Overload capacity	-	110% for 1 Hr. for every 12 Hrs. Operation
Load acceptance within frequency		
Variation 50 \pm 2Hz. and Voltage		
Variation 30% of rated Voltage	-	5 sec. (Recovery time)
Design Ambient	-	50Deg.C
Insulation	-	Class H
Terminals	-	Suitable for Terminating XLPE Al.Ar. Cable

SECTION: 4 - LT PANEL

1.0 SCOPE:

- 1.1 This specification covers the requirements of design, fabrication, testing, packing and supply and erection of Medium Voltage Switchgear (MV Switchgear) consisting of Main MV Panel, Sub Switch Boards etc.

2.0 CODES AND STANDARDS:

- 2.1 The Switchgear assembly shall conform to following Indian Standards
- 2.1.1 IS : 375 - 1961 Switchgear bus-bars, main connections and auxiliary wiring marking and arrangement for (revised).
- 2.1.2 IS : 2147 Degrees of protection provided by enclosures for low-voltage switch gear and control gear.
- 2.1.3 IS : 3914 Selection of AC Induction Motor Starters (voltage not exceeding 1000 volts).
- 2.1.4 IS : 4237 General requirements for switch gear and control gear for voltages not exceeding 1000 V.
- 2.1.5 IS : 8623 Factory-built assemblies of switch gear and control gear for voltages up to and including 1000V AC and 1200 V DC.
Part II particular requirements for bus bar, trunking system (bus ways).
- 2.2 The individual equipment mounted in the switch gear shall conform to following Indian Standards.
- 2.2.1 IS : 772 Part - 1 AC Electricity Meters: Part I General requirements and tests (Second Revision).
- 2.2.2 IS : 1248 Direct acting electrical indication instrument (First Revision).
- 2.2.3 IS : 1822 Motor Starters, AC, of voltage not exceeding 1000 Volts (First Revision).
- 2.2.4 IS : 2208 HRC Cartridge fuse links up to 650 V.

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- 2.2.5 IS : 2607 Air break isolators for voltages not exceeding 1000 Volts (First Revision).
- 2.2.6 IS : 2705 Current Transformer :
Part I General requirements.
Part II Measuring Current Transformers.
Part III Protective Current Transformers.
- 2.2.7 IS : 2959 Contactors for Voltage not exceeding 1000 V AC or 1200 V DC (First Revision).
- 2.2.8 IS : 3156 Voltage Transformers :
Part I General requirements (First Revision).
- 2.2.9 IS : 3231 Electrical relays for power system protection.
- 2.2.10 IS : 4047 Heavy duty air-break switches and composite units of air-break switches and fuses for voltage not exceeding 1000 Volts.
- 2.2.11 IS : 4064 Air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units for voltages not exceeding 1000 V AC or 1200 V DC.
Part I General requirements (First Revision).
- 2.2.12 IS : 6875 Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to and including 1000 V AC and 1200 V DC

3.0 GENERAL REQUIREMENTS:

- 3.1 Medium Voltage Switch Gear shall be metal enclosed, Compartmentalized, Modular type suitable for Indoor installation. The MV Switch gear shall be dust and vermin proof and the enclosure shall be provided with a degree of protection of not less than IP:52 as per IS:2147.
- 3.2 The Switch Gear shall be assembled out of vertical sections of uniform height not exceeding 2000 mm and operating handle of fuse switch unit shall not be more than 1800 mm not less than 300 mm.
- 3.3 The switch gear shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energized and without taking any special precautions. Means shall be provided to prevent shorting of power and / or control terminal due to accidental dropping of maintenance tools etc., inside the switch board. Checking and removal of components shall be possible without disturbing adjacent equipment. All auxiliary equipment should be easily accessible.
- 3.4 All identical equipment and corresponding parts shall be fully interchangeable without any need for resorting to structural modifications.

4.0 FABRICATION REQUIREMENTS:

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- 4.1 The frame of vertical individual vertical panels shall be fabricated using pressed and shaped cold rolled sheet steel of adequate thickness or by using suitable mild steel structural sections. **The frames and doors of all floor mounted panels shall be fabricated by using minimum 14 SWG cold rolled sheet, 12SWG for Gland plate and 16 SWG sheet steel for wall mounted Sub Switch Boards unless specified otherwise in BOQ.** Wherever required, stiffeners for large size doors and covers shall be provided. The panel shall be metal-enclosed, free standing, modular type, suitable for indoor installation. The panel shall be dust and vermin proof and the enclosure shall provide a degree of protection of not less than IP 52.
- 4.2 The switch gear shall be provided with integral base frame for each vertical panel. The switch gear integral base frame shall be suitable for directly bolting with the help of foundation bolts and shall also be suitable for tack welding at two diagonally opposite points to the embedded base frame.
- 4.3 All openings, covers and doors shall be provided with neoprene gaskets around the perimeters to make the switch gear dust and vermin proof.
- 4.4 All hard ware shall be corrosion resistant. All joints and connections of the panel members shall be made by galvanized, zinc passivated or cadmium plated high quality steel bolts, nuts and washers, secured against loosening.
- 4.5 Suitable lifting hooks and / or jacks shall be provided on each panel or shipping section for ease of lifting of switch board.
- 4.6 Each switch board section shall have removable gland plates with adequate number of holes drilled for fixing glands suitable for the incoming and outgoing cables as specified in box (Cost of glands and lugs are not to be included).
- 4.7 The opening for fixing MFM, push button indicating lamps, etc., shall be machine punched.

5.0 PANEL DESIGN REQUIREMENTS:

- 5.1 The Switch Gear shall be formed using distinct vertical sections each comprising following compartments. The fabrication shall be rigid, robust, flaw less and shall have a smooth finish. Due consideration shall be given to the following during design of the panel and locating the various components viz. Circuit Breakers, Instruments & Relays, Bus bar, Capacitors and secondary wiring. Facility of inspection, maintenance & repair. Minimum vibration and noise. Risk of accidental short circuit, open circuit and damage to personnel due to accidental contact with live parts. Shrouding of all live parts in feeder component and cable chamber. All retaining catches, Screws and bolts for doors and covers shall be zinc passivated. Screws and bolts shall be captive. All covers, doors and joints shall be gasketed. Equipment to be mounted outside cubicles shall be flush mounted on cubicle door.

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- 5.1.1 A Completely metal enclosed horizontal bus bar compartment running horizontally at top unless specified at bottom. In case of double bus bar arrangement, the bus bars shall be at top and bottom.
- 5.1.2 Individual feeder modules organized in multitier mode.
- 5.1.3 Completely enclosed vertical bus bars serving all feeder modules in the vertical panel.
- 5.1.4 Cable termination compartment.
- 5.1.5 Perforated sheet steel / insulating material enclosed horizontal auxiliary bus way for control, interlock, indication and metering wiring running horizontally.
- 5.2 Metal sheets shall be provided between two adjacent vertical panels running to the full width of the wider panel and up to full useful height of the switch gear.
- 5.3 Panels shall be in single front execution.
- 5.4 The Switch Gear shall be of compartmentalized, modular construction. All equipment associated with a particular circuit shall be housed in a separate and independent compartment earmarked for that particular circuit in the fixed portion of the vertical panel.
- 5.5 All auxiliary devices for control, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, Ammeters, Voltmeters, KWH Meters, Protective Relays except motor thermal overload relay and single phasing preventer relay, shall be mounted on the front side of the respective compartment only.
- 5.6 **Bus bar sizing, connection and supports:**
 - 5.6.1 Bus bars shall be of high conductivity copper or Aluminium as specified and supported on insulators made of SMC/DNC. The current density of copper bus bar shall not exceed 1.2 A /sqmm and that of Aluminium bus bar shall not exceed 0.7 A / sqmm. The main bus bar shall have uniform current rating throughout their length as indicated in the BOQ. The current rating of the neutral shall be half that of the phase bus bars throughout the length of the switch board for bus bar rating above 100 A. For bus bar rating of 100A & below the neutral bus bar shall be rated for phase current. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.
 - 5.6.2 The bus bar and supports shall be capable of withstanding the short circuit currents stated in the BOQ. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar joints and supports.
 - 5.6.3 The thermal design of the bus bars shall be based on installation of the switch gear in poorly ventilated condition. The cooling air volume shall take into account only the bus bar enclosure and not the air volume of the vertical panels. The maximum

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operating temperature of bus bars at maximum design temperature shall not exceed 85 Deg. C. for normal operating condition and 200 Deg. C for short circuit condition.

- 5.6.4 All bus bars shall be colour coded by means of identifying colour rings at every power tap off point. Red, Yellow and Blue colour shall be used for phase bus bars and Black Colour shall be used for neutral bus bars. They shall be provided with heat shrinkable PVC Insulation of appropriate colour.
- 5.6.5 Minimum clearance between live parts, between live parts / neutral to ground shall be as per CEIG/CEA regulations.

6.0 SPECIFIC REQUIREMENTS OF CIRCUIT BREAKER PANELS:

- 6.1 The Circuit Breaker compartment enclosure shall be as per IS: 2147 with the circuit breaker in position or withdrawn from the compartment. Spring actuated and gravity operated safety shutters shall be provided for isolating the bus bars and other live parts when the breaker is completely withdrawn. The design of the compartment shall be such as to prevent movement of vermin from a particular circuit breaker compartment of any other portion of the panel when the breaker is withdrawn and the compartment door is closed. Suitable isolating barriers shall be provided between circuit breaker and all auxiliary devices for control, indication, metering and protection.
- 6.2 Separate compartment totally enclosed from all sides shall be provided for cable termination, preferably on the rear side of circuit breakers. Access to cables shall be from the rear side after opening the cabling compartment door. The incoming / outgoing cable termination shall be staggered for each circuit and barriers of sheet steel or insulating material shall be provided between terminations of two circuits such that maintenance on one circuit could be carried out while the other circuit is live. Suitable clamping arrangements shall be provided for cables and cable termination / terminal blocks shall not be used for supporting the cables.

The incoming supply for Panels shall be through top entry bus ducts or through bottom entry single core or multi core Aluminium conductor cables. Similarly the outgoing cabling shall have bottom or top entry as per site requirement. The cable terminations shall be suitably sized for receiving specified number of cables per termination and provision shall be made for terminating each outgoing cable with a separate bolted connection. In case the total number of cables entering a particular panel cannot be accommodated in the cabling compartment of Panels an add on type of panel shall be added to the cabling compartment for accommodating extra cables, the enclosure design of cabling compartment shall be such as to prevent the movement of vermin from this compartment to any other part of the switchgear and shall be minimum IP-31 as per IS-2147 with the door closed. In case of busduct entry, the bus duct shall be

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terminated on the TOP of the panel only and the rear portion of panel shall not be used for this purpose.

6.3 **Circuit breaker compartment:**

6.3.1 The Circuit breaker compartment shall be fully draw out, that is, bus side & outgoing power and control connections shall be through draw out contacts (It shall be possible to draw out the withdraw able trolley without having to unbolt or unscrew any power and control connections). Suitable guides shall be provided to facilitate easy withdrawal of the trolley. All identical feeder compartments shall be interchangeable.

6.3.2 The Current Transformers for the Ammeter / Protection Circuits shall be mounted on the fixed portion of the compartment. However, current transformers associated with built-in releases may be mounted on the breaker trolley. All terminals except wiping / sliding type control terminals shall be shrouded with plastic covers to prevent accidental contact. For direct termination - clip on shrouded type (ELMEX Type) terminals shall be provided.

There shall be three positions for the draw out trolley viz:

- “Full in” or “service” position in this position both power and control circuits shall be connected. This shall be then normal operating position of the circuit breaker.
- “Test” position - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the breakers in this positions.
- “Full out” position - Both power and control circuits shall be disconnected in this position. It shall be possible to close the cubicle door in this position.

The circuit breaker shall be lockable in “service”, “test” and “Full out” positions.

The earth connections must remain connected in “test” position, earthing of the unit shall be done with a “pin” or with scrapping earth connections. The earth connection shall make before the main power / control make and break after the power / control contacts are disconnected. Earthing connection through a plug and socket connection shall not be acceptable.

6.4 **Interlocks:**

Following interlocks shall be provided.

6.4.1 Compartment doors shall be interlocked against opening when breaker is in closed or ON condition. However, it shall be possible to bypass this interlock for inspection purposes.

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- 6.4.2 It shall not be possible to push “in” a drawn out circuit breaker in closed condition or withdraw a circuit breaker in closed condition.
- 6.4.3 It shall be possible to operate a circuit breaker only in the defined “Full in” or “Service” and “test” position inside the panel. It shall not be possible to operate the breaker in intermediate positions while inserting or withdrawing a circuit breaker or while in “Full out”, position inside the panel.
- 6.4.4 Mechanical “Castell” interlocks shall be provided for ACB as shown in the BOQ’ / SLD.
- 6.4.5 In case of multiple ACBs of different rating in a panel, a common cutout shall be provided for the entire range of ACBs. These ACBs shall have rating error prevention device to avoid accidental interchange of ACBs.

7.0 SWITCH GEAR COMPONENTS:

7.1 Circuit breakers:

Air Circuit Breakers:

- 7.1.1 Circuit Breakers shall be air break, draw-out type. The ratings shall be as indicated on switch board data sheets and rated for 1000 V insulation rated impulse voltage of 12kV.
- 7.1.2 The circuit breaker shall be provided with microprocessor based for overload, short circuit and earth fault protection.
- 7.1.3 ACB shall have the breaking performance $I_{cs} = I_{cu} = I_{cw} (1\text{sec}) = 50\text{kA}$
- 7.1.4 ACB shall have minimum Mechanical life of 20000 operations
- 7.1.5 The circuit breakers shall be provided with mechanically operated emergency tripping device. This device shall be available on the front of the panel. If available as a manufacturer’s standard design, mechanically operated ‘closing’ device shall be provided for all breakers except circuit breakers controlling motor feeders
- 7.1.6 The Circuit Breakers shall be provided with sufficient normally open and close spare auxiliary contacts, wires and available for Purchaser’s use, if spare auxiliary contacts are not available, an auxiliary relay of approved make shall be used to multiply the available spare auxiliary contact.
- 7.1.7 Circuit breaker positions shall be indicated electrically. The following indicating colours shall be used.
- | | | |
|-----------------------|---|-------|
| BREAKER ‘ CLOSE ‘ | - | RED |
| BREAKER ‘ OPEN ‘ | - | GREEN |
| BREAKER ‘ AUTO TRIP ‘ | - | AMBER |

In addition, if available as a manufacturer standard design, the following positions / conditions shall also be indicated electrically. The colour to be used shall be as indicated below:

- | | | |
|-------------------------------------|---|-------|
| BREAKER DRAW-OUT IN “TEST POSITION” | - | BLUE |
| BREAKER SPRING ‘CHARGED’ | - | WHITE |
- 7.1.8 Circuit Breaker positions (OPEN AND CLOSE), location (SERVICE AND TEST) and spring charged condition shall also be indicated mechanically.

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- 7.1.9 ACB shall have a Ready to close mechanism preferably having a ready to close mechanical indication on front of ACB. All EDO ACBs ready to close indication contact which shall be used to give a single indication via indicating lamps on panel door if ACB is ready to be closed, after checking all the given conditions (UV release energized, Shunt release de-energized, spring charged, Breaker is not "ON", Breaker has not tripped on fault, Breaker is not mechanically interlocked with other breaker and ACB is not racked in completely in service position) ensuring safety for user and electrical distribution.
- 7.1.10 Operating Mechanism:
- a. Electrical Power operating mechanism shall be motor would spring charged energy type. However, manual operating mechanism may be of the spring charging stored energy type or the spring assisted type. For circuit breakers with electrical power operating mechanism, provision shall be made for manual spring charging. Closing time of circuit breakers with manual operating mechanism shall be independent of the speed of the operating handle.
 - b. All stored energy operating mechanism shall be equipped with following features.
 - (i) Failure of springs, vibrations or shocks shall not cause unintended operating of breaker or prevent intended tripping operation.
 - (ii). Closing of circuit breaker shall be prevented unless the spring is fully charged.
 - c. All Electrical power operating mechanism shall be suitable for remote operation and shall be equipped with following features.
 - (i) Provided with universal motor operating on 230 V A.C designed to operate satisfactorily from 85% to 110% of rated voltage.
 - (ii) Provided with emergency manual charging facility. The motor shall be automatically, (mechanically) delinked once the manual charging handle is inserted.
 - (iii) Closing operation of circuit breaker shall automatically initiate charging of the spring for the next closing operation.
 - (iv) One complete closing operation shall be completed once the closing impulse is given and the first device in the control scheme has responded even though the control switch / P.B. is released provided no counter trip impulse is present.
- 7.1.11 Circuit breaker trip and closing coils in case of electrically operated breakers and trip coil in case of mechanically operated breakers and circuit breaker indications shall be suitable for satisfactory operation on 230 V A.C
- 7.1.12 Circuit breaker trip and closing coils shall be rated for satisfactory operation under the following conditions of supply voltage variation:
- a). Trip coil : 50% to 110% of rated voltage.
 - b). Closing coil : 85% to 110% of rated voltage.
- 7.1.13 The Circuit Breaker closing time shall be approximately in the range of 100 to 150 Millisecs. and the tripping time shall not exceed 100 Millisecs.
- 7.1.14 The under voltage relay shall be suitable for operation on 415 V 50 Hz supply and shall be provided with a fixed time delay of 3 to 1 sec.

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- 7.1.15 The breakers shall be trip free. If available as a manufacturer's standard feature, the breakers shall be provided with a release to trip the breakers instantaneously if closed on to a fault.
- 7.1.16 Shunt trip and closing coil (having common AC/DC supply upto 250V) shall be continuous rated. For Incomer ACBs delayed type under voltage release shall be used to avoid nuisance tripping during voltage surges
- 7.1.17 Breaker selection shall be done for 50 degree ambient temperature, suitable deration of ACB shall be considered for carrying full load current.
- 7.1.18 ACB shall have vertical connection for better heat dissipation to avoid over heating problem
- 7.1.19 Releases: If provided, the releases shall have the following features:
 - ◆ The overload release shall be provided with a setting of 50% to 100% of the breaker rated current.
 - ◆ The short circuit release shall be provided with settings corresponding to 200% to 1000% of the rated current and shall be provided with adjustable time delay range of 100 MS to 350 MS.
- 7.1.19.1 In case of static / microprocessor based relays, separately powered, individual fault trip indication LEDs (For overload, short circuit, earth fault and trip unit failure) shall be available on the trip unit which shall function even if the display fails. All trip units provided shall have thermal memory as standard.
- 7.1.19.2 In case of breakers controlling motor feeders the setting values shall correspond to the motor capacity.

7.2 Moulded case circuit breaker (MCCB):

The MCCB shall comprise of switching mechanism, contact system, arc extinguishing device and tripping unit all mounted in a moulded case, made of high strength heat resistant and flame retardant thermosetting insulating material. MCCB shall employ quick make and quick break switching mechanism independent of the speed of operation of the operating handle. The operating mechanism shall be trip free. The operating handle shall indicate the position of the MCCB in ON / OFF / TRIPPED. The MCCB shall be provided with Field settable thermal magnetic relay suitable for short circuit and over load protection. MCCB shall be suitable for horizontal and vertical mounting and with line load reversibility.

- 7.2.1 The circuit breaker 3 or 4 pole shall fully comply with IEC60947(1&2) & IS13947(1&2). Certificate for all the sequences (sequence 1 ,2& 3) should be available. The circuit-breakers shall have no line-load restriction.
- 7.2.2 Circuit Breakers shall be air break and shall be of current limiting type with positive isolation. They shall be fixed type unless specified otherwise. The ratings shall be as indicated on switch board boq. MCCBs should have double break mechanism to limit the let through energy and increase the life of the breaker.
- 7.2.3 They shall be rated for not less than 650 V insulation voltage. The Service breaking capacity shall not be less than the value specified in the switch board boq. ICu of breaker shall be equal to ICs of the breaker.

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- 7.2.4 The MCCBs shall have a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) at 415V. (Ics = 100% Icu)
- 7.2.5 In case of motorized MCCB, the motor voltage will be 230 V.
- 7.2.6 Where accessories such as shunt release, UV Release etc are specified they shall be of drop in type and shall be common for all ranges.
- 7.2.7 The MCCBs of all ranges shall have CPRI certification or any recognized foreign body.
- 7.2.8 The breakers shall be operated by a toggle, which shall clearly indicate the three fundamental position ON,OFF& TRIPPED.
- 7.2.9 All MCCBs shall be provided with Phase Separator, Terminal Covers & Spreader link if the same is available in the Manufacturer's range.
- 7.2.10 The protection scheme of MCCB shall be as follows unless specified otherwise in the BOQ.
 - a) Variable Thermal over load & Fixed Magnetic protection up to 63 A rating (sub panels)
 - b) Variable Thermal over load & Variable Magnetic protection from 100 to 200 A rating (sub panels)
 - c) Micro Processor based Variable Overload and Variable Short Circuit shall be provided for 250A and above in panels.

7.3 **Contactors:**

- 7.3.1 The contactors shall be air break type, equipped with three main contacts and minimum 2 NO + 2 NC auxiliary contacts. The main contacts of a particular contactor shall have AC 3 ratings as shown in the relevant switch board data sheet for that contactor.
- 7.3.2 The auxiliary contacts shall be rated for minimum 5 Amps at 240 V AC and 1.3 Amps at 110 V DC (Inductive Load).
- 7.3.3 Unless specified otherwise, the coil of the contactor shall be suitable for operation on 240 V, 1 Ph. AC supply and shall work satisfactorily between +10 and -15% of the rated voltage.
- 7.3.4 The contactor drop off voltage shall be between 15% to 65% of the rated coil voltage.

7.4 **Thermal overload relay:**

- 7.4.1 Thermal overload relays shall be three element, positive acting, ambient temperature compensated type with adjustable setting range.
- 7.4.2 Thermal overload relays shall be manually reset type with the reset push button brought out on the front of the panel. The reset push button shall be capable of being operated without opening the compartment door.
- 7.4.3 Thermal overload relays shall be provided with minimum 1 NO + 1 NC contacts with a rating of 5 Amps at 240 V, 1 Ph, 50 Hz AC and 1.3 Amps at 110 V DC (Inductive Load).

7.5 **Single phasing preventer (SPP):**

- 7.5.1 Unless specified otherwise, SPPs shall be provided in all motor starter modules. The SPP shall be of the current operated type and shall operate on the principle of sensing negative sequence component of current.

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- 7.5.2 In case of single phasing, the SPP shall operate after a time delay of 2 to 3 secs. The relay shall be of the hand reset type and visual indication of the relay operation shall be available.
- 7.5.3 The SPP shall be suitable for protection of the non-reversible and reversible motors. The relay operation shall be independent of the loading and RPM of the motor prior to the occurrence of single phasing.
- 7.5.4 The SPP shall be fail safe type and shall operate without any external power supply. In case of failure of internal wiring the relay shall trip the motor.

7.6 **Instrument transformers:**

- 7.6.1 Current Transformers shall be tape wound or wire wound type as specified in data sheets. The CT Ratio and VA burden shall be as indicated in the BOQ.
- 7.6.2 Current Transformers shall generally conform to IS:2075. The C.T ratio and ratings shall be as indicated in the BOQ. For general guidance the vendor shall note that the protective current transformers shall have an accuracy class "5P" and an accuracy limit factor greater than "10". Low reactance CTs shall be used for protection.
- 7.6.3 Current Transformers for instruments shall have an accuracy class 1.0 and accuracy limit factor less than 5.0. However, accuracy class of 3.0 is acceptable for Ammeters only. If a metering load is fed from a protection C.T., suitable 1/1 or 5/5 ratio saturable interposing C.Ts shall be used. The current transformers shall be capable of withstanding the peak momentary short circuit and the symmetrical short circuit current for 1.0 second. The neutral side of the current transformers shall normally be earthed through a link.

8.0 **ERECTION:**

- 8.1 It will be the responsibility of Contractor to unload the panel from lorry, store in temporary stores and final shifting for installation.
- 8.2 Before grouting of panels, assembling, paneling and alignment of panels has to be completed. The panel level shall be checked with spirit levels.
- 8.3 The panels and all components shall be cleaned and checked for tightness of all components. All contacts shall be cleaned with CTC. All relays shall be noted by secondary injection.
- 8.4 Provision of MS channels or angle iron for mounting the panels wherever required across the trench etc., shall be included in the cost of erection and nothing extra shall be paid against the same.

9. **ACCL SPECIFICATION & WORKING.**

- 9.1 The ACCL - Current limiting 0.38 KW, 40A -EB 3 Phase & 2.5A in DG- Single phase.
- 9.2 DG load limit settings range - 100Watts to 2.5Kw.
- 9.3 Trip delay & On time range of setting - 10Sec to 30 sec
- 9.4 Overload locking - After 5 tripping cycles (tripping cycles for overload locking can be increased or decreased as per client requirements). Overload locking can be reinstated after 300sec, this time can be increased/ decreased as per client requirements.
- 9.5 LED indication - Main, DG, overload, Out ON, Out OFF.
- 9.6 Electrical/ Mechanical interlocking to avoid reverse feed.

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10. **CAPACITOR PANEL**

10.1. SCOPE:

This specification covers the technical requirements for Design, Engineering, Manufacture, Testing at Works, Supply at Site, Install, Test & Commissioning of 415V **APFCR Panel**, Complete with all accessories for efficient and trouble – free operation.

10.2 STANDARDS:

The equipment covered by this specification shall, unless otherwise stated, be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory Authorities.

IS: 722	A.C. electricity meters
IS:732	Code of practice for Electrical wiring installation.
IS:375	Marking and arrangement for switchgear Bus bar main connections and auxiliary wiring.
IS:1248	Direct acting electrical indicating instruments.
IS:13947	LV Switchgear and Control Gear.
IS:2705	Current Transformers.
IS :3231	Electricity relays for power system protection.
IS:8623	Specification for factory Built assemblies for Voltages. Up to 1000V A.C. and 1200V.D.C
IS:4237	General requirement of switchgear and Control gear for Voltages not exceeding 1000V.
IS:2959	AC Contactors for voltage not exceeding 1000V.
IS:162	Specification for Electric Power Switchgear and Associated apparatus.
IS:2834	Capacitors.

The panel supplied shall satisfy all the requirement of Local Statutory authorities and modification if any required site shall be carried out by the Contractor without extra cost.

10.3 AUTOMATIC POWER FACTOR CORRECTION:

Automatic control of power factor by capacitors shall be provided to achieve, a power factor of 0.99 lagging. To achieve the present desired power factor, suitable microprocessor based reactive power controller to switch ON and OFF the regulating stages shall be provided in the panel. The capacitor shall be sub divided into eight regulating stages. In case of supply interruption, the zero voltage relay shall be provided to reset the control devices to their neutral position as that on restoration of supply, the capacitor stages are switched on again stage by stage, thus preventing any undesirable current / voltage peaks. The panel shall be provided with auto and manual control of capacitors.

10.4 CAPACITOR:

The dielectric system shall consist of polypropylene film and zinc plating electrode. The dielectric shall be wound to form a winding. The winding shall then be coated under vacuum in self-extinguishing resin which forms the casing. The Capacitor shall be rated for 440V. Each capacitor unit shall be provided with inrush current limiting devices within the

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container. The capacitors shall be enclosed in heat proof, dust proof, water proof containers. Each capacitor shall be provided with a fast-acting controller which shall be capable of a very fast response.

Permissible tolerance of capacitor:

- | | | | |
|----|----------------------|---|-----------------------------|
| a. | Operating Voltage | : | +/-10% Max. |
| b. | Output KVAR | : | -5% to +10% |
| c. | Measured loss angles | : | +10% |
| d. | Line Current | : | +30% (including transients) |
| e. | Losses | : | < 0.2Watts per KVAR. |

Note :

The discharge resistor contained in the capacitor unit shall reduce the residual voltage to 50 Volts in less than within 5 minutes after the capacitor unit is disconnected from the source of supply.

10.5 CONTACTORS

Contactor shall be suitable for capacitor duty. The contactor shall be triple pole, solenoid operated air break type with three main contacts and minimum 2 NO+2 NC spare auxiliary contacts. The main contactor shall be suitable for the duty class III category AC6b as per IS: 2959. The auxiliary contacts shall be rated for minimum 5 Amps. at 230 V AC single phase. The contactor drops off voltage shall be between 10% to 75% of the rated coil voltage. All spare auxiliary contacts shall be wired to the terminal blocks for future purposes.

10.6 REACTORS

The reactors shall be 7% detuned reactor and to be specially wound ensuring low hysteresis loss and high harmonic suppression. The reactors shall be provided with filters to take care of 3rd, 5th & 7th harmonics.

Permissible tolerance of reactors :

- | | | | |
|----|-------------------------|---|-------|
| a. | Tolerance of Inductance | : | +/-3% |
| b. | Saturation Limit | : | 1.8In |

10.7 TERMINAL BLOCK:

Terminal blocks shall preferably be grouped according to circuit functions and each terminal block group shall have atleast 20% spare terminals. Terminal blocks for control circuit shall be of 650V grade with contact ratings not less than 10A and stud type.

Not more than two wires shall be connected to any terminal block.

10.8 DRAWING AND DOCUMENTS

The following drawings and documents shall be furnished.

- | | |
|------|---|
| a. | General Arrangement drawing of the panel showing. |
| i. | Overall Dimensions |
| ii | Terminal locations |
| iii. | Total weight |

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- iv. Foundation details
- v. Sectional view
- vi. Sill of materials
- b. Single line diagram and wiring diagram.
- c. Technical details for Switchgear, lamps, meters etc.
- d. Manufacturing schedule and test schedule, Calculation for sizing of bus bars.

SECTION: 5 - MCB DB

1.0 SCOPE:

- 1.1 This chapter covers the Supply, Installation, Testing and Commissioning of **MCB Distribution Boards for lighting and power.**

2.0 MATERIALS AND CONSTRUCTION:

2.1 Enclosure:

- 2.1.1 The Distribution Board shall be fabricated out of 16 SWG Sheet Steel and shall be factory fabricated and shall be duly prewired in the works ready for installation at site.
- 2.1.2 The board shall be wall mounted and shall be with stove enameled paint finish. The M.S Sheet shall have undergone degreasing, acid nickeling and phosphating before powder coated painting.
- 2.1.3 The board shall be provided with loose wire box as a separate compartment for the complete width and depth of the board and with maximum height of 125 mm in case of TPN DBs and 100 mm in case of Single Phase Distribution Boards.
- 2.1.4 The board shall be provided with a hinged cover of 1.6 mm thick sheet steel in the front. DB shall be suitable for indoor / outdoor installation as specified in the BOQ, wall mounting free standing type, in double door construction. The Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sq mm tinned stranded copper connectors. Only the knobs of the MCB shall protrude out of the sheet covers, through openings neatly machine made for this purpose.
- 2.1.5 Knock out holes at the bottom and detachable plates with knock out holes at the top of the board shall be provided.
- 2.1.6 Three phase boards shall have phase barriers and wire channel on three sides.
- 2.1.7 The board shall be complete with the following.
 - a. Solid tinned copper bus bars (Rated 200A)
 - b. Solid tinned neutral bars with tapped holes and chase headed screws. For 3 Phase DBs 3 Nos. independent neutral bus shall be provided.
 - c. Common Earth Bar.
 - d. DIN bar for mounting MCBs.
 - e. Elmex type terminal connector suitable for incoming.
 - f. Earthing studs.
 - g. A set of Neon Indication lamps with HRC Cartridge fuse for each phase of incoming supply where specified.
- 2.1.8 The board shall be fully prewired with single wire PVC Insulated copper conductor of size (as specified below) insulated solid copper links and terminated to extended type

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terminal connections suitable for connections to the size of respective conductors up to 15 A 2.5 sqmm, 25 A 4.0 sqmm, 32 A 6 sqmm, 63 A 16 Sqmm.

- 2.1.9 Circuit diagram indicating the load distribution shall be pasted on the inside of DB as instructed and covered with transparent plastic sheet. Each board shall have engraved plastic name plates fixed to it in the front.
- 2.1.10 The board shall be provided with two brass earthing stud terminals with suitable nuts & washer for connection to earth bus outside the boards.

2.2 **Miniature Circuit Breaker:**

- 2.2.1 The MCBs shall have quick make and break non welding self-wiping silver alloy contacts. They shall have short circuit rating of 10 KA. Each pole of MCB shall be provided with inverse time thermal overload and instantaneous over current magnetic tripping elements with trip free mechanism. In case of multipole breakers, the tripping must be on all poles and operating handle shall be common. Breaker shall conform to BS 3671 with facility for locking in / Off Position.
- 2.2.2 Pressure clamp terminals for conductors up to 2.5 sqmm copper is acceptable and for higher sizes the terminals shall be suitably shrouded.
- 2.2.3 'C' & B series MCBs shall be used for normal lighting circuits, motor loads, and all power circuits as specified in the approved drawing and BOQ.
- 2.2.4 The ELCB/RCCB's shall have sensitivity as specified in the BOQ and shall be of 10KA breaking capacity. In case they have only overload capability additional MCB for breaking under short circuit condition shall be provided at no extra cost.

2.3 **Residual Current Circuit Breaker**

RCCB shall be 4/2 pole 415 volts 50Hz, 30-300mA sensitivity. These shall be of approved make. The rating of the RCCB shall be as specified in BOQ. These shall be suitable for manual closing and opening and automatic tripping under earth fault circuit of 30- 300mA as specified in item of work. The enclosure of the RCCB shall be moulded from high quality insulating material. The material shall be fire retardent, anti-tracking, non- hygroscopic, impact resistant and shall with stand high temperature. All parts of switching mechanism shall be non-greasing, self-lubricating material so as to provide consistent and trouble-free operation. Operation of RCCB shall be independent of mounting position and shall be trip free type. The RCCB shall be protected against nuisance tripping by protective device.

3.0 **TERMINALS:**

- 3.1 The distribution board shall be recessed in wall unless specified otherwise with the outer surface of door flush with the wall.
- 3.2 The frame work shall be suitably grouted in the wall. Minor civil works such as cutting of walls and plastering after erection will be included.
- 3.3 Shop drawings showing the detailed dimensions and design including the disposition of mountings shall be submitted for approval of consultant before fabrication,
- 3.4 All wires to the boards shall be bushed at the entries to avoid damage to the insulation.
- 3.5 When it is required to terminate number of conduits a suitable M.S Adaptor box shall be provided as per direction of the Consultant. All distribution shall be touched up for damaged painting before handing over.

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SECTION:6 - LIGHT FIXTURES

1. AVIATION LAMP

1.1 INTRODUCTION

This specification covers the Technical Requirements of Design, Manufacture, Test and Supply & Installation of Aviation Obstruction Lighting for Multi Storied Building.

1.2 STANDARDS

The equipment shall meet all Relevant Indian Standards and shall also meet the requirements of International Civil Aviation Organization.

1.3 CONSTRUCTION

The light shall be Cluster Type LED Type with Twin Lamp configuration suitable for medium intensity. The fitting shall be provided with inbuilt photo sensor for controlling the lights. The twin lamps shall be independently controlled such that even if one fails, the other one shall function normally. The necessary converters / Adaptors shall be housed in a weather proof enclosure with IP65 degree of Ingress protection. The fitting shall be suitable for operating at hot, humid atmospheric conditions and shall be suitable for operating at 45°C Ambient Temperature without determination of lamp life and internal wiring. The fittings shall be shock proof and vibration resistant. The fixing arrangement shall be robust and shall be suitable to withstand, the wind pressure at the height where it is mounted. The fitting shall be provided with necessary cable box with connector for terminating the incoming cable. The fitting shall be provided with earth studs. The complete control gear shall be housed in an enclosure made of non-rust material. The lamp shall have long life (1,00,000HRs) and shall be maintenance free.

2. SPECIFICATIONS FOR INSTALLATION OF LIGHTING AND OTHER FIXTURES

2.1. CONTRACTOR'S SCOPE

Contractor's scope is to supply all required materials and assemble, install, connect, test and commission the lighting and other fixtures and lamps. The supplies and works shall be carried out in compliance with the relevant rules, regulations standards, and codes of practice and requirements of the Employer.

The scope of Contractor's work will include but not be limited to the following:

- Supplying at site all materials and accessories for installing the fixtures and connecting them to the respective outlets.
- Safe storage of all materials, till these are required for installation.
- All transporting and handling of the materials.
- Inspection of all materials and arranging prompt action to rectify and defect/damage/discrepancy/shortage noticed.
- Installation of the materials.
- All civil works required in connection with erection as provided under "Conditions of Contract".
- Testing and commissioning.

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- Any modifications and/or repairs which may be found necessary by the Engineer on completion of inspection/tests and during the Defect Liability Period.

In the case of equipment and accessories supplied by the Employer, the Contractor's scope will include the following:

- Receiving the equipment and accessories at site from the carriers and unloading.
- All transporting and handling of the materials at site.
- Safe storage at site.
- Repacking of the equipment and accessories after inspection and safe storage till these are required for installation.

2.2 ELECTRICAL FIXTURES

- All lighting fittings shall be complete with accessories & fixtures necessary for installation whether so detailed under item description or not.
- Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box or fixture opening.
- Fixtures shall be completely wired & constructed to comply with the regulations & standards for electrical lighting fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name & factory inspection label unless otherwise approved.
- Wiring within the fixtures & for connection to the branch circuit wiring shall be not less than 1.5 Sq.mm copper for 250 Volt applications. Wire insulation shall suit the temperature conditions inside.
- Fixtures with visible frames shall have concealed hinges & catches. Recessed fixtures shall be constructed as to fit into an Armstrong /Gypsum/POP false ceiling.
- Detail catalogue or, if so required by the architects, sample fixtures shall be submitted to the Architect for approval. Shop drawings for non-standard fixtures shall be submitted to the Architects for approval.

3. INSTALLATION OF ELECTRIC FITTINGS:

- Fixtures shall be installed at mounting heights as detailed on the drawings or as instructed on site by the Architect.
- Fixtures or outlets boxes for fixtures shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers & methods of fastening shall be submitted to the Architects for approval prior to execution at site.
- All LED lighting fixtures shall be fixed with down rods or on round blocks as stated in the schedule of quantities if required. Fixtures like down lights, spot lights etc. shall be fixed to the false ceilings as per manufacturer's recommendations.
- Non-current carrying metal part of every lighting fixture and other fixture shall be effectively earthed.

SECTION: 7 - CONDUIT & WIRE

1.0 SCOPE:

This chapter covers the detailed requirement for wiring work in Rigid PVC Conduits in surface and recess/Concealed.

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2.0 **STANDARD APPLICABLE:**

Indian Electricity Act 2003, CEA regulation 2023 and Indian Electricity Rules 1956 amended up to date. Relevant Indian Standard codes of Practice for type of work as per appendix.

3.0 **MATERIALS:**

3.1 **Rigid PVC conduits:**

- (i) The conduit pipes and accessories shall be of suitable material complying with IS:2509 - 1973 and IS:3419 - 1976 for rigid conduits. The interior of the conduits shall be free from obstruction. The make shall be as specified.
- (ii) The conduits shall be circular in cross section. The conduits sizes are designated by their nominal outside diameter. The dimensional details shall be as follows:

S.N o.	Nominal Outside Diameter	Maximum Outside Diameter	Minimum Inside Diameter	Maximum Permissible Eccentricity	Maximum Permissible
1	20	20 + 0.3	17.2	0.2	0.5
2	25	25 + 0.3	21.6	0.2	0.5
3	32	32 + 0.3	28.2	0.2	0.5
4	40	40 + 0.3	35.8	0.2	0.5

Note: All Dimensions are in MM.

3.4 **Conduit accessories:**

- (i) Bends, Couplers etc., shall be solid type in recessed type of work and may be solid or inspection type as required in surface type works.
- (ii) Saddles for fixing conduit shall be heavy gauge.

3.5 **Wires:**

All Wires shall be Multistrand Electric Grade Copper, FRLS HFFR PVC Insulated as per IS 694 and 1100V Grade. The colour coding of wires shall be as follows:

PHASE

R

Y

B

N

EARTH

CONTROL

COLOUR OF WIRE

RED – Phase

YELLOW - Phase

BLUE – Phase

NEUTRAL – BLACK

GREEN (Insulator)

GREY

3.6 **Outlets:**

- (i) **Switch Box:** A rectangular box shall be made of metal on all sides except the front.
- (ii) The depth of the boxes shall not be less than 60 mm and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.
- (iii) An earth terminal with stud and 2 metal washers shall be provided in each MS box for termination of protective conductors and for connection to socket outlet / metallic body of fan regulator.

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3.0 The size of switch boxes shall be suitable for fixing modular plates of switches of the makes specified.

- (v) The cover of the Switch Boxes shall be moulded plates of modular design to fix switches and socket outlets.

3.7 **Switches & sockets outlets:**

- (i) Control Switches shall be of moulded plate type of modular design with silver plated contacts.
- (ii) The socket outlets shall be 3 pin with switch and plate type cover. The sockets shall be of shuttered type where specified in the schedule of work.

4.0 **INSTALLATION:**

4.1 **Conduit Points:**

- a. Conduit work of each circuit section shall be completed before cables are drawn.
- b. Conduit Pipes shall be joined by sleeved coupler and sleeved accessories only . In case of rigid PVC Conduit, all points shall be sealed / cemented with an approved cement.
Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling than through the pipes.

4.2 **Making Chase:**

The chase in the wall shall be neatly made and of ample dimension to permit the conduit to be fixed in the wall. In case of buildings under construction, the conduit shall be buried in the wall before Plastering and shall be refilled and brought to the finish of the wall neatly after erection of the conduit. In case of exposed brick / marble masonry work, special care shall be taken to fix the conduit and accessories like Switch Boxes and Junction Boxes along with building.

4.3 **Fixing Conduits in Chase:**

The Conduit pipes shall be fixed by means of staples, hooks or means of saddles not more than 60 cm apart or by any other approved mans of fixing.

4.4 **Fixing Conduits in RCC Work:**

The Conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed to the steel reinforcement bars to avoid their dislocation while cement concreting and subsequent curing of the same. Fixing of standard bends or elbows shall be avoided as far as possible, and all bends shall be maintained by bending the conduit pipe itself with long radius which will facilitate easy drawing of conductors. Where conduits pass through expansion joints in the building adequate expansion fittings shall be used to take care of relative movement.

4.5 **Fixing Inspection Boxes:**

Suitable inspection boxes to the minimum requirement shall be provided to permit inspection and to facilitate replacement of wires if necessary. These shall be mounted flush with the wall or ceiling concrete in case of recessed conduit system.

4.6 **Surface Conduits:**

- a. Conduit Pipes shall be fixed by saddles, with sleeves in an approved manner at an interval of not more than and 60 cm in respect of rigid PVC Conduit but on either side

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of coupler or bends or similar fittings. Saddles shall be fixed at a distance of 30 cm from the centre of such fittings.

- b. In respect of rigid PVC Conduits, if the pipes are susceptible to mechanical damage, they shall be adequately protected.

4.7 **Fixing of Outlet Boxes:**

Only a portion of the switch box shall be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

5.0 **LIGHT AND POINT WIRING:**

5.1 **Wiring System:**

- a). Supply, Erection, Testing and commissioning of PVC insulated FRLS HFFR copper wire in FRLS PVC heavy duty (2mm thick) conduit along with Modular 6A one way switch with moulded front plate, GI anodized enclosure and other associated accessories as required as per the site conditions. All metal boxes to be earthed with copper wires. A shop floor drawing shall be submitted and got approved before commencing the work. Color of the switches, sockets and front plates would be as per approval. PVC/GI Flexible Hose shall be included in the S&I from the false ceiling to light fitting. Circuit mains will be covered separately. (1) From Switch board to first light/socket/fan will be termed as primary point (2) From primary point to subsequent loop point on the same circuit shall be termed as secondary point.
- b). The internal wiring shall include the wiring of light/fan/outlets to the distribution board via switch to the point. Circuit mains will be covered separately. Individual junction/inspection boxes shall be provided for each light fitting for the purpose of looping from fitting to fitting.
- c). All fixing accessories such as clips, brass screws etc. included.
- d). All the switch boxes, ceiling fan regulator, outlet and junction boxes shall be covered with modular cover plate as per specifications.
- e). All necessary material to complete the wiring as specified.
- f). 1100 volts grade FRLS PVC insulated copper conductor stranded flexible PVC insulated wire of green colour for earthing of outlet boxes, light fixtures, and socket outlets.
- g). Embedding conduits and fittings in walls/ceiling etc. during construction including cutting chases and making good the same as necessary in the case of concealed conduit work.
- h). Outlet boxes and junction box.
- i). Providing GI saddles of approved quality and make and grouting the same for any exposed conduit work.
- j). All socket outlets shall be shuttered type with earth terminal.
- k). Lighting and power circuits shall be kept separate.
- l). All Junction boxes for fans and lights shall be covered with 3 mm thick hylam sheet or PVC fan box/JB cover (White colour) properly.
- m). The minimum conduit size shall be kept 20 mm.
- n) The Colour of the modular switch socket as per ID and client's requirement.
- o). Contractor to measure the length as per the actual requirement, and no extra claim shall be entertained.
- p). Where joint box system is specified in the Tender Documents, all joints in the conductors shall be made by means of approved mechanical connectors in suitable and approved junction boxes.

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- q). The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switch gear.
- r). while drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends.
- s). Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing. PVC insulated copper conductor wire ends before connection shall be properly soldered (at least 15 mm length) with soldering flux / copper solder, for copper conductor. Strands of wires shall not be cut for connecting to the terminals. The connecting brass-screws shall have flat ends. All looped joints shall be soldered and connected through terminals block / connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross section are exceeding 4 sq. mm shall always be provided with crimping type cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections.
- u). Only certified wire man and cable jointers shall be employed to do joining work.

5.2 Joints in Wiring:

- 5.2.1 No joints in wiring is permitted. If the length of final circuit to a submain is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.
- 5.2.2 The termination of multi strand conductors shall be done using suitable crimping type lugs for size more than 4 sqmm.
- 5.2.3 All final branch circuits conductors shall be as shown in schedule of quantities and a drawing.
- 5.2.4 No other wiring shall be bunched in the same conduit except those belonging to the same phase and each conduit shall not have more than three branch circuits. In case of three phase loads, separate conduit shall be run from distribution boards to the load points or outlets as the case may be.

5.3 Earthing Requirements:

- (i) The entire system of metallic conduit work including the outlet boxes and other metallic accessories shall be mechanically and electrically continuous by properly screwing at points or by double check nuts at termination. The conduit shall be continuous when passing through walls or floors.
- (ii) Protective (loop earthing) conductor (s) shall be laid along runs of the conduit between the metallic switch boxes and the distribution boards / switch boards, terminated thereto. The protective earth conductors shall be drawn either inside conduits along with cables, or shall be laid external to the conduits. When laid external to the conduits, this shall be properly clamped with the conduits at regular intervals.
- (iii) The protective conductors shall be terminated properly using earth studs, earth terminal block etc., as the case may be.

5.4 Fixing of Wiring Accessories:

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- (i) Control Switches shall be 'ON' when the knobs are down. Control Switches shall be placed only on the live conductors of the circuit. No single pole switch or fuse shall be provided in the protective earth conductor or earthed neutral conductor of the circuit.
- (ii) The Switch Box and socket outlets shall be installed based on interior drawing. The contractor shall submit for approval, the shop drawing of conduit layout indicating the route of the conduits, number and size of the conduits, location of junction / inspection / pull / outlet boxes, size and location of switch boxes, number and size of wires pulled through each conduit and all other necessary relevant details prior to laying of conduits. Only after the drawings are approved, the contractor shall proceed with the work of conduit laying. In respect of rooms the location shall follow approved mock-up room layout. As location of outlets are liable for change, only such changes which are done after approval of shop drawing in respect of public area and after approval of mock-up room in respect of rooms will be eligible for payment as actuals.

6.0 MEASUREMENTS:

6.1 Point Wiring:

The wiring for light points, fan points, exhaust fan points, bell points and 5A Socket outlets shall be measured on unit basis by counting.

The following shall be deemed to be included in the point wiring.

- ◆ Conduits and its accessories and wiring cables between the switch box and point outlets.
- ◆ All fixing accessories such as saddles, screws, rawl plugs etc., as required.
- ◆ Metal / PVC Switch Boxes for control switches, regulators sockets etc., and moulded plate cover / plastic laminated sheet cover for the same.
- ◆ Outlet boxes, junction boxes, pull through boxes etc., along with their covering sheets including metal boxes provided with switch boards for housing wire / conduit termination.
- ◆ Control Switch as specified.
- ◆ Connection to ceiling roses, connector socket outlet, lamp holder / switch etc.,
- ◆ Inter connecting wiring between points of the same circuit on the same switch box and from another.
- ◆ Protective (loop earthing) conductor from one metallic switch box to another in the distribution circuits and for socket outlets, fittings etc.

6.2 Group Controlled Point Wiring:

In case of point with more than one point controlled by same switch / MCB, such points shall be measured as one point depending on the number of points controlled by one switch / MCB as specified in the BOQ. The wiring from the MCB the first point connected to the MCB shall also be considered as one point.

6.3 5 Amps Socket Outlet:

6.3.1 Dependent Socket Outlet:

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Each socket outlet fixed in switch box and phase, neutral and earth looped from adjacent / same switch box shall be measured as one dependent socket outlet.

6.3.2 Independent Socket Outlet:

Socket outlet including boxes, socket, switch etc., for which conduit is laid and wires drawn from DB or another switch board shall be measured as Independent Socket outlet.

6.4 Submain and Circuit Wiring:

These shall be paid on linear basis along the run of the conduit, including junction boxes, bends etc., from the top of the distribution board to the top of the switch board.

6.5 System of Wiring :

The system of wiring is with FRLS HFFR PVC insulated copper wire with FRLS HFFR PVC insulated copper wire as for earth protection wire.

SECTION: 8 – CABLING & CABLE TRAY

1.0 SCOPE:

This specification covers the requirements for supply, the installation, testing and commissioning of the **cabling and cable tray**.

2.0 STANDARDS:

The following standards shall apply:

IS : 1554 Part I

IS : 2098 Part II

IEE Wiring regulation.

3.0 CABLE SPECIFICATIONS:

3.1 Power Cables:

Power cables for use on 415 V systems shall be of 1100 Volts grade, aluminium/cu stranded conductor, XLPE insulated, PVC sheathed steel wire / tape armoured and overall PVC sheathed. Power Cables for 11 KV systems shall be aluminium conductor, XLPE insulated, screened, PVC bedded galvanized steel flat armoured and PVC sheathed cable. Cable shall conform to relevant IS Specification.

4.0 MISCELLANEOUS MATERIALS SPECIFICATIONS:

4.1 Connectors:

Cable termination shall be made with aluminium / tinned copper crimped type solderless lugs of approved make for all aluminium/cu conductors and stud type terminals.

4.2 Method of Construction:

Before fixing of lugs to the cable end, the cable end to the equivalent length of the lug shall be prepared by removing the outer PVC insulation along with the steel armouring and then, the inner PVC insulation. The paste shall be applied to the cable lead and inside the lug prior to the inserting of lug on the cable lead. The lug shall then be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping

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shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped with the PVC insulation tape. (Colour of tape shall be of that of cable lead) The above method shall be carried out for all the cores. The cable end with lug shall then be terminated into the terminal and then be tightened with either brass nuts or Cadmium plated nuts as directed by Engineer in-charge.

4.3 Cable Identification:

Cable tags shall be of 2 mm thick, 20 mm wide aluminium strap or plastic identification tags of suitable length to contain cable number, equipment no. etc.,

4.4 Cable Glands:

Cable Glands to be supplied shall be double compression type. Made of high purity brass metal, nickel plated with brass washers, rubber rings, threaded stud with washers and nuts.

5.0 CABLE LAYING:

5.1 Cables shall be laid in the routes marked in the drawing. Cable routing given on the layout drawings shall be checked in the field to avoid interference with structures, heat sources, drains, piping, air conditioning duct, etc., and minor adjustments shall be done to suit the field conditions wherever deemed necessary without any extra cost. Procurement of cables shall be on the basis of actual site measurements.

5.2 High voltage, medium voltage and other control cables shall be separated from each other by adequate spacing or running through independent pipes, trenches or cables trays, as applicable.

5.3 Cables shall be laid in complete, uncut lengths from one termination to the other whenever the length required is not more than Standard lengths manufactured.

5.4 Cables shall be neatly arranged in the trenches / trays in such a manner so that crisscrossing is avoided and final take off to the motor / switch gear is facilitated.

5.5 RCC Cable trenches with removable covers will be provided by the civil contractor. Cables shall be laid in 3 or 4 tiers in these trenches on steel supports. Removal of concrete covers for purposes of cable laying and reinstating them in their proper positions after the cables are laid shall be done by the electrical contractor at no extra cost.

5.6 LAYING OF CABLE IN TRENCH

MS supports to be used for the cable laying. The cables shall be clamped to the cable supports by using SS/Aluminium clamps at an interval of minimum of 1 mtr.

5.7 TESTING BEFORE LAYING

At the time of issue of cable for laying, the cables shall be tested for continuity and insulation resistance.

5.8 EXTRA LOOP CABLE

At the time of original installation, approximately 2 to 3m of surplus cable shall be left on each terminal end of the cable as instructed by the engineer incharge and on each

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side of the underground joints. The surplus cable shall be left in the form of a loop.

- 5.9 Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Engineer-in-charge before cutting is done. The cable entries through pipes from outside to inside the buildings shall be sealed water tight with approved type of sealant to avoid water entering into the building.
- 5.10 At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given to that the cables do not slack and get damaged by pipe ends.
- 5.11 Cables installed above ground shall be run in trays, exposed on walls, ceilings or structures and shall be run parallel or at right angles to beams, walls or columns.
- 5.12 Individual cables or small groups which run along structures / walls etc., will be clamped by means of G.I./Al saddles on saddle bars at intervals not exceeding 300 mm for cables up to 25 mm dia and at 500 mm for higher size cables. The cost of saddle and saddle bars shall be deemed to have been included in the installation of cables and no separate payments shall be made on this account.
- 5.13 Cable laid on supporting angle in cable trenches, structures, columns and cable trays shall be suitably clamped by means of G.I./Al Saddles / Clamps.
- 5.14 Supporting steel shall be painted before laying of cables. The painting shall be done with one coat of red lead paint and two coats of approved bituminous aluminium paint unless otherwise specified.
- 5.15 Cable tags to be provided for each cables contain the following details: 1) Cable size and run 2) from and to location. The details to be engraved in the cable tag, to be fixed at both end of the cables.

5.8 CABLE TRENCHING

5.8.1 WIDTH OF TRENCH:

- a. The minimum width of the trench for laying a single cable shall be 35cm.
- b. Where more than one cable is to laid in the same trench in horizontal formation, the width of the trench shall be increased such that the inter-axial spacing between the cables, except where other specified, shall be at least 20cm.
- c. There shall be a clearance of at least 15cm between axis of the end cables and the sides of the trench.

5.8.2 DEPTH OF TRENCH

- a. Where the cables are laid in a single tier formation, the total depth of trench shall not be less than 75cm for cables up to 1.1 KV
- b. When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of the trench in above shall be increased by 30cm for each additional tier to be formed.
- c. Where no sand cushioning and protective covering are provided for the cables as per above, the depth of the trench as per above shall be increased by 25cm.

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6.0 TERMINATION:

- 6.1 All PVC Cables up to 1.1 KV grade shall be terminated at the equipment / switch boards by means of compression type cable glands.
- 6.2 The cable armouring shall be earthed at both the ends.
- 6.3 Cable termination up to 4 sqmm shall be insertion type and others crimped type Aluminium / Copper Sockets. Conductor jelly shall be applied before crimping after cleaning the surface.

7.0 TESTING:

- 7.1 M.V Cables testing shall be done with 1000 Volts Meggar and that of H.V Cables with 5 KV Meggar. The following test shall be done
 - a. Continuity on all phases.
 - b. Insulation Resistance between Conductor and between Conductors to earth.
- 7.2 All tests and records done in the presence of Engineer - in - charge and shall form part of completion document.

8.0 MODE OF MEASUREMENT:

- 8.1 Cables will be measured on the basis of common rate per unit length irrespective of the type of laying. The cost shall include cable, clamps, excavation, sand filling, and refilling, cable markers and installation, testing and commissioning.
- 8.2 Cable termination will be measured as one unit for payment. The cost shall include glands, lugs, nuts, joint material, earthing of glands, installation, testing and commissioning.

CABLE TRAY**1.0 GENERAL:**

The cable management system shall consist of well designed, field proven products based on popularly accepted international practices. Manufacture and finish shall be complete at the works. No welding should be expected to be done at site for installation. All products used indoors /outdoors shall be Hot Dip Galvanized.

2.0 LADDER TYPE AND PERFORATED CABLE TRAYS:

Shall consist of a Bolted rung assembly of field proven design. It shall consist of side rails of 2.5 mtr standard lengths and Slotted rung spaced 250mm center to center. Coupler, Coupler fasteners, tray assembly fasteners should form the part of the equipment. The Ladders & perforated should be light sheet metal constructions yet robust enough to carry a sufficient cable load on a span of 1.25 mtrs. The design shall be flexible enough to accommodate change of widths at site. Sections of 1.6/2mm shall be standard for different widths of trays as detailed in BOQ. However, where locations demand lighter sections those too shall be detailed in BOQ.

3.0 CONSTRUCTION:

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The cable trays shall be either ladder or perforated type. The cable trays and accessories shall be fabricated out of hot rolled steel sheets, which shall be hot dipped galvanized. The complete assembled cable tray sections shall be corrosion resistant, high strength and with extreme smooth surface. Cable tray manufacturer shall supply suitable accessories for clamping the cable trays on cable tray supports from ceiling and beams of the building structure. Cable trays shall be supplied with GI coupler plates, hardware, nuts bolts and washers for joining the standard lengths of cable tray section.

4.0 PAINTING:

If necessary, at site - only, especially after cutting / jointing. The metal surface after cleaning shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. After preparation the tray surface shall be painted with two coats of yellow paints.

5.0 EARTHING:

The cable tray /floor raceways shall be provided with brass earth clamps for connecting suitable copper wire earth continuation.

SECTION:9 – EXTRA LOW VOLTAGE SYSTEM

1. Scope

To provide wiring for CCTV, telephone, TV & Data on surface of wall or ceiling concealed in slab, wall, under flooring etc., through existing rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified.

2 Conduits:

Conduits shall be Heavy gauge Rigid PVC conduit. The conduit shall generally be as specified ion the BOQ.

3.0 Cables and Wires:

3.1 The type of cables and the services shall be as follows:

- i) Indoor Multi pair, PVC insulated sheathed armored and sheathed.
- ii) Inside Twin core PVC insulated with conduit twisted cores.

3.2 All multi core cables and wires shall be of tinned copper conductor of not less than 0.5 mm dia and shall be colour coded twisted pairs with rip cord.

3.3 The conductor resistance shall be less than 150 ohms per KM and the insulation resistance between the conductors not less than 50 mega ohms and the nominal capacitance of about 0.1 micro farad per kilometer.

3.4 Cables laid underground or locations subject to dampness and flooding shall be filled with polyethylene compound and shall have sufficient protection against moisture and water ingress.

3.5 All armouring shall be of galvanized steel wires and protected against corrosion by an outer sheath of PVC in the case of indoor cables and polyethylene in the case of outdoor cables. Outer sheathing must be fire retarding and anti-termite.

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- 3.6 All un-armoured single core cables and inner sheath of armoured cables shall be provided with rip cord.
- 3.7 All single pair cables for final extension to the telephone outlet box shall be un-armoured tinned copper conductors of not less than 0.5 mm. diameter and shall be drawn in conduits. All telephone outlets shall consist of 2 A 2 pair polythene connector in G.I box with modular plate and modular RJ 11 Telephone socket..
- 3.8 Saddles: Saddles fabricated from G I sheet of required gauge (16/18 gauge) either galvanized finish or painted with superior quality enamel black paint, with necessary shearing for mechanical strength, semicircular shaped with extended piece having suitable holes for fixing on spacer.
- 3.9 Junction box: Manufactured by reputed manufacturer of specified capacity, facility for wall mounting, with door & lock, aluminium frame, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour.
- 4.0 Installation:
- 4.1 The installation of conduits shall generally be as specified under section 'CONDUIT WIRING'.
- 4.2 All cables shall be on cable racks and neatly stitched together.
- 4.3 The connection at the tag blocks shall be silver soldered so as to achieve minimum contact resistance.

TECHNICAL SPECIFICATION

1. NETWORK VIDEO RECORDER (NVR)	
Sl No	Specification
1.	NVR shall have 32-channel network video recording system that supports real-time video/audio, live viewing and playback.
2.	NVR shall work with Linux/Windows Operating System.
3.	NVR shall have a smart H.265+/smart H.264+/ H.264/H.265 high quality decoding system.
4.	NVR shall have Automatic IP search and “One-Click” IP camera import.
5.	NVR shall support ONVIF Profile S, HTTPS
6.	NVR shall support exporting recorded video to popular video formats like mp4/mov etc.
7.	NVR shall have HDMI / VGA outputs. Preferably HDMI output
8.	NVR shall support motion detection.
9.	NVR shall support different recording mode viz. Manual, Schedule, Motion detection trigger and Alarm trigger.
10.	NVR shall support different search mode viz. Date/Time, Event (Alarm, Motion detection), Accurate search (to second), etc.
11.	NVR shall support different playback modes viz. 1/16 channel simultaneous playback (Forward / Reverse, Fast playback, Slow playback, Freeze, Full screen, Shuffle, Backup selection)

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12.	NVR shall support different protocols viz. HTTP/HTTPS, TCP/IP, RTSP, UDP, NTP, DHCP, IPC Search etc.	
13.	NVR shall have Remote Control Function to Monitor, Playback, Configuration, File download, Log information	
14.	NVR shall have Network Interface, USB Interface, and Serial Interface.	
15.	NVR shall have a rack mountable structure.	
17.	NVR should be fully licensed and the license should be perpetual/valid lifetime without any kind of usage restrictions	
18.	Provide Optical wireless Mouse for access	
2. FIXED TYPE IP BULLET CAMERA		
SL No	Specification	
2.1	Fixed Type IP outdoor Bullet Camera shall have high definition 2560/1440P, True Day/Night feature crisp video with providing streaming images at full frame rate for continuous surveillance in indoor and outdoor areas.	
2.2	STQC Compliant.	
2.3	Fixed Type IP Bullet Camera shall support Event triggering such as camera tampering, Motion detection, Network loss, Alarm Input, Video loss etc.	
2.4	Pixel	4 MP
2.5	IR Beam Distance	30 m
2.6	Video Compression	H.264+/H.265+/H.264/ H.265
2.7	Frame Rate	Support 20 fps or more
2.8	WDR	120dB
2.9	Color Mode	Normal / Natural / Bright
2.10	Motion Detection	
2.11	Night vision facility and back light compensation	
2.12	Protection - IP67 weather-proof Protection	
2.13	Provide PVC box with mounting accessories	
3. FIXED TYPE DOME CAMERA		
SL No	Specification	
3.1	Fixed Type DOME Camera shall have high definition 2560/1440P, True Day/Night feature crisp video with providing streaming images at full frame rate for continuous surveillance in indoor and outdoor areas.	
3.2	STQC Compliant	

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3.3	Fixed Type DOME shall support Event triggering such as camera tampering, Motion detection, Network loss, Alarm Input, Video loss etc.	
3.4	Pixel - 4 MP	
3.5	IR Beam Distance 30 m	
3.6	Video Compression - H.264+/H.265+/H.264/ H.265	
3.7	Frame Rate - Support20 fps or more	
3.8	WDR - 120 dB	
3.9	Color Mode - Normal / Natural / Bright	
3.10	Motion Detection	
3.11	Night vision facility and back light compensation	
3.12	Protection - IP67 weather-proof Protection	
3.13	Provide PVC box with mounting accessories	
4. 8 TB SURVEILLANCE STORAGE HARDDISK		
SL No	Specification	
4.1	Capacity: 8 TB	
4.2	SATA 6Gb/s	
4.3	Compatible for 32 channel NVR	
4.4	Compatible for CCTV surveillance data recording and playback.	
5. 65” LED DISPLAY WITH CONNECTING CABLES		
SL No	Specification	
5.1	The Color display shall be suitable with the standards of the selected cameras. It shall be solid state and modular in design. It shall provide a bright, clear and well defined picture display on the screen.	
5.2	All controls for brightness, contrast etc. shall be provided on the front panel for readily adjusting the levels of the video signal. The rear panel shall be provided with input and output connectors for coupling the video output to other Monitors.	
5.3	The Screen size of display shall be 65 inch	
5.4	The Display Resolution shall be 1920 x 1080	
5.5	Backlight	LED
5.6	Connectors	VGA, HDMI
5.7	AC input	Voltage/frequency/current 100 240 VAC/50 or 60 Hz ±3 Hz/1.5A (typical)
5.8	Provide wall Mounting brackets	

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5.9	Provide power cable and Communication cable - Provide communication cable (HDMI/VGA) to establish connectivity from NVR to Display
6. CAT-6 23AWG UTP CABLE	
SL No	Specification
6.1	23 AWG Annealed bare solid copper, CAT-6 UTP Cable
6.2	Support for Fast Ethernet and Gigabit Ethernet. Should meet TIA / EIA 568 standards
6.3	PAIRS Colour code: Blue / White-Blue, Orange / White-Orange Green / White-Green, Brown / White – Brown
6.4	PVC Outer Sheath - Outer Diameter 6mm minimum
6.5	ELECTRICAL CHARACTERISTICS at 20° C Input Impedance: 100 + 15 Ohms
6.6	Mutual Capacitance: Minimum 5.0 nF/100m Capacitance or higher
7. 24 port Network POE Switch	
SL No	Specification
7.1	24 port Gigabit PoE switch
7.2	Ports: 24 x 10/100/1000 Mb/s Gigabit Ethernet (RJ45) PoE+
7.3	Rack mounting Type
8. 12U RACK	
SL No	Specification
8.1	Provision to accommodate Network Switch and NVR for proper stack mounting.
8.2	Rack should be 12U and wall mount type with accessories
8.3	Rack should be provided with cable management accessories. 1U Cable manager, rack mount type PDU with 12 Nos. Sockets of 5 Amp
8. INSTALLATION, CABLING AND TERMINATION ACCESSORIES	
Shielded RJ-45 connector fit for 23 AWG STP cable.	
Provide all connectors /cables/accessories/Junction box required for the termination and completion of project	
PVC Conduit Pipe with all accessories for laying and clamping Cables	
Certification: ISI Mark	

SECTION :10 – EARTHING

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1.0 SCOPE:

- 1.1 This Specification covers the essential requirement of **Earthing system** consisting of earthing stations, earth conductor laying and connection to Panel boards/ Distribution Boards etc.
- 1.2 For details not covered in these specifications, IS Code of Practice on Earthing (IS: 3043-1987/ latest amendment) shall be referred to.

2.0 APPLICATION

- i) The electrical distribution system is with earthed neutral (i.e. neutral earthed at the transformer/ generator end). In addition to the neutral earthing, provision is made for earthing the metallic body of equipment and non-current carrying metallic components in the substation, as well as in the internal/ external electrical installations.
- ii) Earthing system is also required for lightning protection, ups installations etc., for function reasons.
- iii) Earthing requirements are laid down in Indian Electricity Rules, 1956 as amended from time to time, and in the Regulations of the Electricity Supply Authority concerned. The basic system of earthing shall be TNS.

3. STANDARDS:

- 3.1 The earthing installation shall be carried out in the best workman like manner confirming to this specification and to the latest Indian Standards and other statutory provisions.
 - a) Code for practice for earthing IS: - 3043
 - b) Indian Electricity Act and Rules/ CEA rules.
 - c) Local Electrical Inspectorate Regulations. In case of conflict, the instructions of Consultant shall be binding.

4. EARTHING STATION:

- a. The earthing station may be pipe earth electrode or plate earth as per Bill of Quantities and shall conform to the attached drawings.
- b. The earth electrode shall be driven preferably to reach permanently moist soil. It is preferable that soil around the electrode has fine texture, which is packed by watering and ramming as tightly as possible. Wherever possible the soil shall be dug up and all stone and lumps removed from around the electrode.
- c. Earthing electrode shall not interfere with roads, building foundation etc., They shall be located atleast 1.5 Mtr away from the building. The location and numbers shall be got approved from the Consultant/owner before execution.
- d. The resistance of each earth station shall not exceed 5 Ohms. In case of higher resistance, further improvement of soil resistivity shall be carried out as per instruction of consultant.

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5. EARTHING LEAD AND CONNECTION:

The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a heavy duty pvc pipe in the case of wire, and heavy duty pvc pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be fixed on walls. The earthing conductor shall be securely connected at the other end to the earth stud/ earth bar provided on the switch board by Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and, Bolt nut and washer in case of strip conductor.

In case of copper electrode jointing shall be by copper riveting with fish plate and brazing. In

case of G.I the same shall be by means of lap welding All joints below grade shall be protected by giving two coats of bitumen and covered with Hessian tape / polythene-based

hessian. All hardware used for earth lead connection shall be hot drip galvanized zinc passivated. Spring washers shall be used for equipment earth connection. All metallic junction and switch boxes shall be provided with an earth stud to which earth lead shall be

connected. The stud shall be painted distinct green or yellow. Armoured Cables shall be earthed to two distinct earth connections to the armouring at both the ends.

6. INSTALLATION

6.1 Electrodes

i. Various Types Of Electrodes

a). Supply, installation, testing and commissioning of GI Pipe Electrode Earthing Station conforming to IS 3043, comprising of 2.5m long, 40mm dia 'B' Class GI pipe conforming to IS 1239 Part-1, GI watering pipe with funnel and mesh, earth flat clamp with removable test link OR molecularly bonded copper of 99.9% purity on low carbon steel of min 3048mm length (10 feet), having a diameter of 20mm with copper bonding thickness of 250 microns as per UL 467 (Earthing to be done as instructed by the engineer in charge). Complete with necessary excavation, backfilling using approved low resistivity soil / earthing enhancement compound, brick masonry chamber of size 450mm x 450mm x 600mm with 150mm thick PCC 1:3:6 base, 200mm thick brick walls, SFRC heavy duty cover, double side plastering, identification plate, painting and testing of earth resistance, complete as required. The earthing station and the test link shall be numbered and identified by SS/ brass identification plates. Including double side plastering, Marking with one coat of primer paintings. Earth resistance after installation shall be measured and recorded as per IS 3043. The Rod has to be fault current withstand capability of 30 KA rms value for 1 second and I peak of 76 KA. Exothermic welded Clamp for clamping as suggested as per NBC 2016. Earth enhancing mineral compound is used for improving the soil conductivity. The material shall be mineral inert to sub soil and shall not pollute the environment and non-corrosive to earth rod. The material should have a resistivity less than 0.2 Ω m. It should be free from hazardous substances.

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b). The plate earth electrode shall consist of copper plate specified in the BOQ. Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3 m below the ground level. The installation shall be carried out as shown in drawing.

ii. Artificial Treatment of Soil

When artificial treatment of soil is to be resorted, the electrode shall be surrounded by charcoal/ Earthing compound as mentioned in the BOQ.

c) Earth Conductor

In the case of plate earth electrodes, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.

In the case of pipe earth electrodes, wire/strip type earthing conductor shall be secured as indicated in drawing using a through bolts, nuts and washers and terminating socket.

d) Earth Bus And Main Earthing Terminal

In all installations, main earthing terminal shall be provided at the main switchboard. This may be in the form of earth stud or single earth bar depending on the type of the switchboard.

Following conductors shall be terminated on to the main earthing terminal.

- 1) Earthing conductor from electrode.
- 2) Protective conductors
- 3) Equipotential bonding conductors.

e) Protective (Loop Earthing/ Earth Continuity) Conductor

Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/ terminal of the upstream switchboard by protective conductors.

Two protective conductors shall be provided for a switchboard carrying a 3-phase switchgear thereon.

Earth Resistance - The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus.

Marking

- i) Earth bars/ terminals at all switch board shall be marked permanently, as 'E'. All the earth conductors to be painted with green or yellow colour.
- ii) Main earthing terminal shall be marked 'SAFETY EARTH- DO NOT DISCONNECT'.
- iii) The Cable armoring shall be connected to earth stud in case of street light poles.

7. TESTING:

The following tests shall be conducted and recorded as per the attached Earthing Installation

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Testing Report Proforma.

- i. Earthing resistance of individual electrodes (the electrode shall be disconnected from grid during test).
- ii. The Earthing Resistance of grid after connecting all electrodes the same shall not exceed 1 ohm.
- iii. The Earthing Resistance of each Electrical System a system neutral earth.
- iv. The Earthing Resistance at each earth provided for lightning conductor.

8. MODE OF MEASUREMENT:

Each earth station complete with excavation, electrode, watering pipes, soil treatment, masonry chamber, CI / RCC Cover shall be treated as one unit for measurement. Earthing leads from earth station to switch board, motor, etc., shall be measured and paid per unit length. The cost will include end termination clamps, saddles, supports, excavation, refilling, etc., as required. The earthing of Lighting Fixtures, Switch Gear / Starter mounting in the Switch Board, Conduit Wiring, Cabling, etc., shall become part of cost of item and no separate payment shall be made.

SYSTEM EARTHING

All electrical equipment is to be earthed by connecting two earth tapes from the frame of the equipment to a main earth ring. The earthing ring will be connected via several earth electrodes. The cable armour will be earthed through cable glands. Earthing shall be in conformity with provision of rules 32, 61, 62, 67 & 68 of Indian Electricity Rules 1956 and as per IS-3843-1966.

The following shall be earthed:

- Transformer & D.G. Set neutrals.
- Transformer Housing.
- H.T. Panels.
- Non-current carrying metallic parts of electrical equipment such as switch boards, motors, distribution boards, cable trays etc.
- Generator & motor frames.
- All fixtures, sockets outlets, fans, switch boxes and junction boxes etc. shall be earthed with PVC insulated copper wire as specified in item of work. The earth wires ends shall be connected with solderless bottle type copper lugs.
- The third pin of Outlets on UPS shall be provided with a separate PVC insulated Cu. Wire (green with yellow stripe) as Isolated ground earth wire apart from the earthing of box.

The shop drawing for earthing system shall be prepared by the contractor and be got approved by Engineer-in-charge. The work shall be done in accordance with approved drawings. All earth electrodes shall be given to a depth sufficient to reach permanently moist soil. Their location shall be marked and approval taken from Engineer-in-Charge before excavation for the same. The earth electrodes shall be tested for earth resistance by means of a standard earth test ohms meter. All tests shall take place during the dry months, preferably after a protected dry spell.

The resistance to earth shall be measured at the following: -

- a. At each electrical system ground or system neutral ground.
- b. At one point on each grounding system used to ground electrical equipment

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enclosures.

- c. At one point on each grounding system used to ground wiring system enclosures such as metal conduits and cable sheaths or armoured.

Testing and Commissioning

Testing and commissioning shall be done as per the programme/ instructions to be given by OWNER's authorized representative. All testing equipment necessary to carry out the tests shall be arranged by the electrical Contractor. Before the electrical system is made live, the electrical Contractor shall carry out suitable tests to the satisfaction of OWNER that all equipment wiring and connections have been correctly done and are in good working condition and will operate as intended. All tests shall be conducted in the presence of the OWNER authorized representative by the electrical Contractor and shall be notified one week before tests are to take place. All measurements shall conform to establish minimum acceptable test values. OWNER's Engineer reserves the right to approve all test results before circuit or equipment are energized for the first time.

INTEGRATED LIGHTNING PROTECTION SYSTEM+PME

Structural Earthing and Structural bonding system shall conform to the requirements of IS/IEC 62305 (all parts) as well as NBC 2016. The system shall solve the purpose of earthing for safety, Lightning protection for the structure, shielding against Electro Magnetic Pulse, base for Equipotential Bonding of electrical and electronic systems etc and provide maximum safety against touch and step potentials during a lightning / electrical fault as well as protect electronic installations against radiated surges. The system also shall conform to the requirements of IEC 61643-4-44 as well as ISO 30129.

Structural bonding system consists of an additional conductor installed inside an RCC column along with structural steel. The conductor shall be of continuous length from basement to the top of the building or maximum 100 meters long, copper coated solid round 10 mm conductor. The conductor shall have minimum joints and all joints shall be exothermically welded for application in soil and under foundation. Clamp joints are permitted only inside concrete / exposed in air. The coating thickness of conductor shall conform to IEC 60364-5-54 and shall be minimum 70 microns.

Note: The structural earthing shall be carried out by an authorized contractor having a minimum of two completed projects of a similar profile.

3.1 EARTH CONDUCTOR & EARTH STUD:

The earth conductor (10 mm round, 70 microns copper coated steel – As per drawing and BOQ) shall be used as dedicated earth conductor in concrete as well as ring earth in case if the foundation have water proof plastic membrane. Earth studs are for the purpose of bringing the electrical connection between structural steel with other steel installations in the building. Both earth conductor as well as earth stud shall be corrosion resistant and shall be tested acc. to IEC 62561. Earth stud shall be connected to earth conductor by exothermic welding.

3.2 BUILDING WITH PLASTIC WATERPROOF MEMBRANE:

The installation need to be carried out before installing the waterproof membrane, preferably below PCC. The earth conductor shall run under waterproof membrane as a grid of 10 meter by 10 meter. The grid shall be extended up to floor level outside the plastic membrane. All joints shall be exothermically welded and in addition wrapped with corrosion protection bandage. Puncturing of water proof membrane is not permitted in case if this “under

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foundation earthing” is not carried before laying the waterproof membrane. Alternatively ring earthing with vertical earth electrodes at floor level can be done with special care. At floor level / above water proof membrane, the conductor shall be connected to Steel in RCC columns, plinth beams. Suitable corrosion free measures to be carried out.

3.3 BUILDINGS WITHOUT WATERPROOFING:

In case of raft / mat foundation which is in electrical contact with soil (without water proof plastic membrane) earth conductor running throughout the RCC as a mesh of 20 meter X 20 meter exothermically welded in all joints, connected to foundation steel at every 5 meter with a tested connector and every 1 meter with braid wire need to be installed.

3.4 BUILDINGS WITH FOUNDATION OTHER THAN RAFT / MAT FOUNDATION:

Earth conductor shall run throughout the interconnected plinth beam. Plinth beam at the outer wall / perimeter of the building shall have earth studs at every 10 meter for the purpose of ring earthing interconnections.

3.5 DOWN CONDUCTOR FOR LIGHTNING PROTECTION AS WELL AS BONDING CONDUCTOR FOR ELECTRICAL INSTALLATIONS (RCC BUILDING):

(As per drawing and BOQ)

The dedicated copper coated 10 m round conductor shall run inside columns and must be connected to the reinforced steel available in the columns will serve the purpose of down conductor for lightning protection as well as base for Equipotential bonding in every floor of a multistoried building. If the distance between 2 columns are lesser than 5 meter, alternate columns shall be selected to route the down conductors. If the distance is more than 10 meter, all the columns shall be used for down conductor routing depending on the class of lightning protection selected.

Provisions for interconnection of metal frame of wall cladding shall be provided at every 5 meters in vertical and horizontal sections based on the architectural design. Training for making this interconnection shall be provided to facade supplier / installer.

3.6 DOWN CONDUCTOR FOR LIGHTNING PROTECTION AS WELL AS BONDING CONDUCTOR FOR ELECTRICAL INSTALLATIONS (PEB BUILDING):

Steel Columns and / or metal façade interconnected to foundation Conductor through earth stud / foundation bolt satisfying the requirements of IS/IEC 62305 need not require separate down conductor.

3.7 EARTHING FOR SAFETY OF LV NETWORK:

Additional earth studs need to be installed in places where electrical panels & electronic equipment are installed. (Note – For apartment building with TN-C network wiring, earth stud near the electrical incoming panel in an individual apartment will do the job of earthing of the complete apartment provided the protective devices are rated suitably. However in case of other wiring networks such as TN-S, TT, this method may not work efficiently depending upon the protective device used for automatic disconnection of power supply)

In buildings where the complete low-voltage installation including the transformer is operated only by the user which is likely to contain, significant amounts of electronics / information technology equipment, TN-S system earthing should be installed.

All electrical rooms as well as every 5 meters in electrical shaft must have a local equipotential bonding earth stud extended from the structural earthing. Sizing of this earth stud for electrical room shall be based on the Short circuit current requirements of the electrical system. In addition earth studs for the purpose of testing the efficiency of protection

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system shall be provided in easily accessible places at top and bottom of the building at every 20 meters.

3.8 TESTING OF DOWN CONDUCTOR:

If structural earthing is used as a part of lightning protection system, overall resistance shall not be more than 0.2 ohm when measured between the air termination and the earthing test point provided at the ground level.

3.9 AIR TERMINATION SYSTEM:

The Air termination system (Horizontal/Vertical) in the roof shall be according to Lightning protection Level specified in NBC 2016. The air termination system consisting of vertical rods and or mesh shall be connected to the structural conductor through earth studs provided at the parapet / columns of the building. For this purpose sufficient earth studs with provision of mechanically strong connection need to be provided at the parapet / wall / column at the top of the building. Air termination system shall be installed strictly after completion of the installation of all roof mounted electrical / metal installations.

For building with metal roof, the air terminal shall be directly connected to the steel roofing sheet with special leak proof screws. Bonding of roof steel and structural support columns shall be ensured by installing braided wires at every 10 meters.

SECTION: 11 – SOLAR POWER PLANT

Supply, Installation, Testing, and Commissioning of 30 KWp On-Grid Solar Photovoltaic (PV) Power Plant

The work includes supply, installation, testing and commissioning of 30 KWp on-grid solar PV power plant conforming to BIS, IEC, MNRE guidelines and Central Electricity Authority Regulations. The plant shall include the following components and features:

Solar Photovoltaic Modules

- High energy efficiency **Mono Crystalline silicon modules** of capacity **590 Wp or above** Mono perc half cut panels or latest model with 10 years of product warranty.
- Conformance: **IS 14286 / IEC 61215, IS/IEC 61730-Part 1 & 2.**
- **Conversion efficiency:** $\geq 23\%$ at STC; temperature coefficient of P_{max} better than -0.30% per $^{\circ}\text{C}$.
- Warranty: $\geq 90\%$ of rated capacity at 10 years; $\geq 80\%$ at 25 years.
- Environmental operation: Relative humidity up to 100%, temperature range -10°C to $+85^{\circ}\text{C}$.
- **RFID tag** on each module containing manufacturer, manufacturing date, country of origin, I-V curve, serial number, model, wattage, I_m , V_m , and FF.
- 25 Years of linear power output warranty.
- Extreme weather resilience.
- Windspeed - 2400 Pa, Snowload - 5400 Pa.
- Highly reliable anti-reflective coated glass.
- 1500 Vdc.
- PID resistant

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Module efficiency must be min 20%. Must comply with relevant IS/ IEC standards. Whenever more than one module is required, identical modules shall be used.

Inverter/ Power Conditioning Unit (PCU)

Supply and installation, testing and commissioning of 30 kW Grid tie inverter with

- 10 years warranty
- Single and Dual MPPT for optimum generation
- Wide Input Voltage Range
- Maximum 98.2% Inverter Efficiency
- In-Built 25 Year Data Storage Capability
- Remote Monitoring –
- LCD display
- Detachable cover for easy installation & maintenance
- Safety Protection- Anti islanding, Ground Fault monitoring
- Anti Reverse Power Controller - zero export (Optional)
- IEC Certification - As per MNRE

THD:<3%. DC

Voltage ripple content shall be not more than 1%. PF: 0.9 (lag or lead). No-load losses: Less than 1% of rated power. Casing protection levels: Degree of protection: Min IP-65. Operating ambient Temp range: 10 to + 60 degree Celsius. Operation: Completely automatic including wakeup, synchronization (phase locking) and shut down MPPT: MPPT range must be suitable to individual array voltages. Protection Class: 1. Protections: Over voltage: both input and output. Over current: both input and output. Over / Under grid frequency. Over temperature. Short circuit. Lightning. Surge voltage induced at output due to external source. Islanding Humidity: 95 % Non-condensing. Must comply with relevant IS/ IEC standards.

- AC output: 415 V, three-phase, 4-wire, 50 Hz ± 2.5 Hz
- Capable of fully automatic operation: wake-up, synchronization, shutdown.
- Protection against unbalanced loads as per IEC standards, with shutdown/standby mode.
- Features grid islanding detection and manual disconnect pole isolation switch.
- Minimum protections:
 - Mains under/over voltage
 - Overcurrent
 - Over/under grid frequency
 - Over temperature
 - Surge voltage from external sources
 - Short-circuit
 - Lightning
 - Anti-islanding (for grid-synchronized mode)
 - Other protections as per applicable standards
- Communication interface: RS 485, RS 232 and Ethernet

Module Mounting Structure

- **Aluminium / Galvanized MS structure** as per **IS 4759**.
- Designed to withstand **wind load** and **seismic parameters**.

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- Material to conform to **BIS codes**; corrosion resistant and electrolytically compatible with module frame and fasteners.
- Maintenance and cleaning arrangements provided (necessary ladder and walk way to be provided).

Array Junction Box & Main Junction Box

- IP 65 rated, made of GRP / FRP / Powder-coated Aluminium / Cast Aluminium alloy/poly carbonate.
- Full dust, water, and vermin proof.
- Includes:
 - Termination for incoming/outgoing cables with glands and lugs
 - Metal oxide varistors (MOVs) / surge arrestors
 - Reverse blocking diodes
 - Isolation switches to disconnect DC input from inverter
 - Copper bus bars

Lightning, Surge, and Earthing Protection

- Proper **earthing system** for modules, PCU, and metal structures should be done as per CEA.
- **Lightning and surge protection** devices should be installed.
- Compliance with **grid islanding safety** and relevant standards.

DC & AC Distribution Boards

Supply Installation Testing & Commissioning of thermo plastic enclosures of DC DB with or without door, conforming to IS 13032 and IS 8623 including DIN rail and fixing suitable MCB and SPD providing dummy covers etc. fixed on wall using suitable anchor bolts or fixed in recess including cutting suitable size hole on the wall, making good the damages, colour washing etc. complete as required.

- IP65, free-standing, metal-cladded
- Copper bus bars with required protection and control gears
- Complete connection and interconnection for PV system

Note:

1. All the materials required for the successful completion of the work is under the scope of contractor.
2. The design with necessary drawings to be submitted and taken approval from CSL prior to the execution of the work.
3. All the materials (specification) used for the work should be taken approval by CSL work in charge prior to the procurement.

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ACCEPTED LIST OF MATERIALS

Name of work : Construction of multi-storey (G+11) employees residential quarters at Cheriyakadavanthra

Tender No : CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS/2026/2

1. CIVIL WORKS			
Sl.No.	Material		Material Make
1	Cement	:	Ultratech, Adani Ambuja, Dalmia, Zuari, Coromandel
2	Steel reinforcement	:	TATA, JSW, SAIL, VISAG
3	Batch Mix Concrete (BMC) / Ready Mixed Concrete (RMC)	:	From computerized batching plant installed by the contractor of suitable capacity and arrange for transit mixers / pumps etc. as per approval of Engineer – In-Charge. OR The RMC shall be procured from the source as approved by Engineer- In-Charge. RMC producing plants of the main Cement producers shall be preferred.
4	Emulsion Paint, suitable Primer, wall putty	:	Asian paints, Berger, Birla opus, Jotun (Premium Quality)
5	Epoxy Paint	:	Asian paints, True coat, Birla opus
6	Vitrified/Ceramic Tiles	:	Kajaria, Somany, Johnson, RAK
7	Epoxy Grout for Tiles	:	Laticrete, Roff, Mapai, Ramco, Cera
8	Adhesive for wall tiles/cladding tiles	:	Pidilite, Sikka, Fosroc, BASF, Laticrete
9	HPL Sheet	:	Century, Merino,
10	Anti-Termite	:	Dr. Sarups, PCI, Pestasia
11	Mirror /Glass	:	Saint Gobain, Modiguard, AIS Asahi
12	Aluminium Section	:	Hindalco, JSW, india aluminium Co
13	Cement fiber board	:	Everest, Sheraboard, Vboard, Ramco hyles
14	Ferro cement (Planter box)	:	Ferrocone, Rogins Fibre glass
15	Rain water gutter	:	Euro guard, Aqua star
16	Rolling shutter	:	Glide Master
17	Steel door	:	TATA Pravesh or substantially equivalent
18	Flush door	:	Kelachandra, Jackson, Jacdoor, Sero door
19	Toughened Glass	:	Modi, Gold Plus, Sejal, Saint Gobain
20	PVC door shutter	:	Sintex, Alco, Polyex
21	FRP door shutter	:	Everlast, Fibertech composite P.ltd

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22	GI channels sections	:	Gyproc-Gypserra, Knauf- Thundersteel, Everest.
24	Rectangular, Square & Circular Hollow Sections, Top & bottom plates of columns (Mild Steel)	:	TATA, JINDAL
25	Interlock Paving Tiles	:	Sirex , Unistone , Nimco Prefab
26	Cement concrete tile	:	Ultra ,Eurocon
27	Welding Rod	:	Advani, Essab, Ador, Modi
28	Fire check steel door	:	Godrej, Sakthi-Hormann Limited, Navair, Pacific
29	Glass Door handle	:	Ozone, Hafele ,Shivalik
30	Floor Spring	:	Ozone, Hafele , Dorma, Titan
31	Glass door lock	:	Dorma, Ozone, Hafele
32	Anchor Fastener	:	HILTI, Fischer, Fosroc
33	Grid Ceiling - Metal	:	Armstrong/Knauf/USG
34	Gypsum board (Moisture Resistant board)	:	Gyproc, Saint gobain, Knauf,
35	PVC false ceiling	:	Jeno from M/s Syntex, Duroplast, Knauf
36	Stainless Steel pipe	:	Salem Stainless Steel, Jindal, Vizag, Jsw
37	Film for glass	:	3M, LG
38	Self-tapping screw	:	Corro shield, HP
39	Door stopper	:	Hafele,Hettich,Ebco,Dorma,Geze, Yale
40	Door closer	:	Dorma kaba, Ozone NSK-580, Hafele, Godrej
41	Door Locks	:	Godrej, Harrison, Link, Doorset, Dorma, Gaze
42	Water proofing agent	:	MYK, Fosroc, BASF, SIKA, Pidilite
43	Adhesive for wood work	:	Fevicol, Araldite
44	Concrete Additive	:	Sikka, CICO, Pidilite, Fosroc, Fairmate, BASF
45	Fire Barrier compound	:	Fosroc, Fisher, Alstroflam, Abacus
46	Fire: Hinges	:	Becker Fire Solution, Inersoll Rand, Dorma
47	Fire: Tower Bolts	:	Suzu, Nulite, Dorset, Dorma
48	Polycarbonate Sheets	:	Galina, GE Plastic, Skyarch, Polytechno, Tuflite
49	Pre-coated Galvanised Steel Sheet	:	Tata BlueScope, Llyod Insulations India Ltd,

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			S.R.Metals
50	PVC Water Stops	:	Prince , Supreme, Finolex , Astrol
51	Sanitary fixtures, CP Fittings	:	Jaquar, Cera, Hindware
52	PVC Pipes and specials	:	Supreme, Finolex, Hycount, Astral
53	Water Supply Fittings	:	Jaquar, Cera, Hindware
54	uPVC Pipes and specials	:	Supreme, Finolex, Hycount
55	CPVC pipes	:	Astral, supreme, Ashirvad
56	C.P. Grating for Floor Trap	:	Chilly Gratings, Sanjay Chilly Gratings or Approved Equivalent
57	Ball Valves (Brass), Non Return Valve (Brass)	:	Rb, sks, zoloto, NVR
58	Butterfly valve	:	AUDCO, Keystone Saunders, Zoloto, NVR
59	Foot valve, NRV, Y Strainer	:	INTERVALVE, AUDCO, Kartar
60	Water Level Controller	:	Aquatech , Minelac
61	Air Release valve	:	RB, TBS, CIMBRIA
62	Water lift pump	:	Kirloskar, CRI, Lubi
63	FRP manhole cover	:	Simtex, Everlast composites, Nexgen, Ashirvad
64	Ductile Iron / Cast Iron Manhole Covers	:	NECO, Muncast, HP Strongdrain, Vikrant, Thermodrain
65	Filter feed pump	:	Kirloskar, Johnson, Wilo
66	Blower	:	A1, Everest, Akas
67	MBBR media	:	Aquatech International, Cooldeck
68	Bubble diffuser	:	Anjaneya International, Cooldeck
69	Dosing pump	:	Aqua, E dose
70	Pressure sand filter	:	Pentair, Tata
71	Activated carbon filter	:	Pentair, Tata
72	MCCB	:	L&T, Siemens
73	Isolator	:	L & T, Siemens
74	Control Cables	:	Finolex, Havells, Polycab

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75	Power Cables	:	Gloster, Polycab, Capital, Bloster, Universal, Havells
76	Voltmeter	:	Meco, AE
77	Indicating Lamp	:	L&T, Teknic
78	Push Button	:	Teknic, Siemens
79	Auto/Manual Switch	:	Salzer, Kaycee
80	Timers	:	EAPL, AE, L&T
81	Butterfly Valve	:	CRI, Intervolve, Audco, KSB, Kartar
82	Non Return Valve	:	CRI, Intervolve, Kartar, Normax, Advance
83	Fire Brigade Inlet	:	Arihant, Kartar, Life guard, Subham
84	Branch Pipe	:	Arihant, Kartar, Life guard, Subham
85	Hydrant Valve	:	Winco, New Age, Arihant, Kartar, Life guard, Subham
86	Hose Reel	:	Arihant, Kartar, Life guard, Subham
87	Fire Hose	:	New Age, Arihant, Kartar, Life guard, Subham
88	Alarm Panel	:	Ravel/ Agni Suraksha, Carmel, Hony Well
89	Smoke Detector	:	Apollo, System Sensor
90	Manual Call Point	:	Ravel, Agni Suraksha, Carmel/Hony Well
91	Hooter	:	Ravel, Agni Suraksha, Carmel, Hony Well
92	PVC Conduit	:	Asian, Balco
93	Pressure Gauge	:	Air tach, H.Gur, Akvalo
94	Pressure Switch	:	Indfoss, Danfoss
95	Alarm Cable	:	Finolex, Havells, Polycab
96	Wrapping Coating	:	Pype Coat, Hotalco
97	Fire Extinguisher	:	Excellent, Ceasefire, Safex, Safe pro
98	Hose Box	:	Minimax, Newage, friends, anaswara
99	Ball valve	:	Kartar, Prime
100	Air Release Valve	:	Atom, Kartar

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101	Foot Valve	:	Kalpana, Kirlosker
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SI No	Item	Makes
2. SOLAR GRID TIE SYSTEM		
1	Solar panel	As per latest ALMM issued by MNRE
2	LT panels	CPRI Approved vendors
3	Inverter	SMA/ABB/Fimer/Schneider/Solar Edge/Delta/Growatt/Power One or substantially equivalent.
4	Array Junction Boxes	Hensell/Spellsberg/Equivalent of reputed make
5	1.1 KV XLPE Cable	AC side cable: Lapp/ Hellukabel/ TKD/ Finolex/ Havells/Polycab/Gloster or substantially equivalent.
6	Solar Dc Cable	DC side cable: Lapp/Hellukabel/TKD/ Polycab/Gloster or substantially equivalent.
7	Bidirectional Energy Meter	EM3555 of Schneider/Equivalent of L&T/Selec or substantially equivalent.
8	Unidirectional Energy Meter	EM6436H of Schneider/Equivalent of L&T/Selec or substantially equivalent.
9	AC and DC Distribution Boxes	Hensell/ Spellsberg or substantially equivalent.

3. ELECTRICAL WORKS		
1	Transformer – USS	Resitech/Intrans/Unitech/Unipower/ voltamp or substantially equivalent
2	Diesel Generator	Cummins/ CAT /Kirloskar/Greaves/Ashok leyland/ Sterling/ Powerica/ Stamford/ or substantially equivalent
3	RMU add on unit	ABB
4	LT Panels	CPRI Approved vendor
5	HT/LT Cables (XLPE)	Polycab/RR Kabel/KEI/Gloster/APAR/Avocab/ /Lapp/Finolex/Havells or substantially equivalent
6	FRLS HFFR wires	RR Kabel/Polycab/KEI/Gloster/ /Lapp/Finolex/Havells/Helu or substantially equivalent
7	MCB's/Isolators/RCBO/RCCB	Legrand/L&T/Schneider/ Seimens/ABB/Hager/ C&S or substantially equivalent
8	ACB/MCCBs/ATS	Schneider/L&T/Siemens/ABB/ Legrand/HAGER or substantially equivalent
9	UPS/ Invertor	Delta/Numeric/Hykon or substantially equivalent
10	Battery (Lead Acid/Maint free)	Panasonic/Exide/Amaron/Tata Green/ SF Sonic or substantially equivalent
11	Indicating Meters	HPL/ L&T/ Meco/ Rishabh/Elmeasure or substantially equivalent

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12	kWH, kW Meters/TOD	HPL/ L&T/Enercon/Meco/ Rishabh/ Universal/ABB/ Schneider or substantially equivalent
13	Multi-function meter	Schneider/Siemens/Elmeasure/ ABB or substantially equivalent
14	Power Contactors	L&T/ABB/Scheider/C&S/Siemens or substantially equivalent
15	Capacitor	L&T/Conzerv/SHREEM or substantially equivalent
16	Earth leakage relay	L&T/ELMEASURE/ABB or substantially equivalent
17	Protection relays	L&T/ABB/Scheider/C&S/Siemens or substantially equivalent
18	APFC Relay	L&T/Siemens/ABB/Schneider/C&S or substantially equivalent
19	Surge Protection Device (SPD)	CAPE/OBO Bettermann /Havells/ ABB/ Legrand or substantially equivalent
20	LT cable termination kit	Rechem/M-Seal/Birla-3M/ Denson or substantially equivalent
21	Distribution Boards	Legrand/Schnieder/HAGER/V-guard/ Seimens/ L&T/ABB/C&S or substantially equivalent
22	Rubber Mat	ISI Mark
23	Street light & poles	Kesslec/Changi/Bajaj /Philips/Havells/Crompton/Wipro/ Luker or substantially equivalent
24	LED fittings	Wipro/Havells/crompton/Jaquar /Bajaj/Philips/Luker or substantially equivalent
25	Starter	L&T/ Siemens/ Schneider /ABB/BCH or substantially equivalent
26	Cable gland	Dowell's/Jainsons /Hex/Commet or substantially equivalent
27	Flexible PVC pipes & glands	C&S /Gesiss/Precision /Polycab or substantially equivalent
28	Cable ties	Hellermann Tyton or substantially equivalent
29	Crimping sockets/lugs	Dowell's/Jainsons /Hex or substantially equivalent
30	Enclosure	CAPE/OBO Bettermann /Hensel/Spelsberg or substantially equivalent
31	PVC Pipes & Accessories	Balco/Toms/Konseal /Precision/ Polycab/ ESPEE or substantially equivalent
32	CAT6 Cable	RR Kabel/Polycab/KEI/3C3 /Finolex/Lapp or substantially equivalent
33	Push Buttons	L&T/Siemens/ABB or substantially equivalent
34	Perforated Cable tray	Niedex/HITECH/ OBO Bettermann or substantially equivalent
35	Switches,Socket & Accessories	Legrand Myrius/Schneider Livia/ C&S or substantially equivalent
36	Exhaust Fan/Ceiling fan	Havells/Crompton/Atomberg /Polycab/Bajaj/ Luker or substantially equivalent

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37	Ceiling Rose	Anchor by panasonic/Havells or substantially equivalent
38	ACCL	Sinewave/ C&S /legrand or substantially equivalent
39	Maintenance free earthing/ earthing	CAPE/OBO Bettermann /Erico/Furse or substantially equivalent
40	Fire Barrier compound	NDE-Fischer/OBO Bettermann or substantially equivalent
41	ILPS+PME	CAPE/OBO Bettermann or substantially equivalent

4. FIRE ALARM SYSTEM:

1. L.V Power / Control Cables : Polycab / Universal /ICC/Nicco/Finolex or substantially equivalent make.
2. PVC Conduits : Avon Plast/ Aero plast/ AKG/ Polycab or substantially equivalent make.
3. Accessories For PVC Conduit : Avon Plast/ Aero plast/ AKG/ Polycab, or substantially equivalent make.
4. MS Conduit/ Accessories : Wimco/BEC / Gupta / Supreme, or substantially equivalent make.
5. Fire Alarm Panels : Edward / GST / Honeywell / Morley / Simplex /Apollo/ Ravel or substantially equivalent make.
6. Manual Call point : Edward / GST / Honeywell /Apollo/ Morley/Ravel or substantially equivalent make.
7. Sounder : Edward / GST / Honeywell / Apollo/ Morley, or substantially equivalent make.

5. Extra Low voltage system -Data and Voice System

Pvc conduit& accessories	Precision/Balco /Conseal /Avon Plast/ Toms/ Polycab/ ESPEE/VIP or substantially equivalent make
Gi back boxes	Mk/Legrand/schneider/Wipro/ Molex / Amp or substantially equivalent make
Utp cat 6 cable, 4 pair	D link/schneider//Belden/ Molex/ Legrand/ Amp or substantially equivalent make
Data socket, rj 45	Mk-Blenze/Legrand artier/schneider-Opale/Wipro-Platia/ Molex/ Legrand/ Amp or substantially equivalent make
Face plate for TV, Telephone & Data points	Mk/Legrand/schneider/Wipro / Molex/ Legrand/ Amp or substantially equivalent make

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Switches, modules, transceiver (all active components)	D link/cisco/juniper/ Molex/ Legrand/ Amp or substantially equivalent make
Rack	Rittal/Netrack/schneider/d link/Valrack/ Legrand or substantially equivalent make
6. IP based CCTV system	
PVC conduit& accessories	Precision/ Balco /Conseal /Avon Plast/ Toms/ Polycab/ ESPEE/VIP or substantially equivalent make
CAT 6 cable, 4 pair	D link/schneider//Belden/ Molex/ Legrand/ Amp or substantially equivalent make
Patch panel (all passive components)	D link/schneider/amp/cisco/ Molex/ Legrand or substantially equivalent make
Rack	Rittal/Netrack/schneider/d link/ Valrack/ Legrand or substantially equivalent make
Dome/Bullet/ptz camera	Honeywell/Pelco/Bosch/axis / Hikvision/ Dahua, Hikvision/ Dahua/CP Plus or substantially equivalent make
Network video recorder	Honeywell/Pelco/Bosch/axis / Hikvision/ Dahua, Hikvision/ Dahua /CP Plus or substantially equivalent make
Hard disk	Seagate/Thoshiba/WD or substantially equivalent make
Led display	Lg / Samsung/ Panasonic or substantially equivalent make
PoE Switches / Modules / Transceiver – Active components.	D LINK/JUNIPER/CISCO/ HP/ Netgear or substantially equivalent make
Application software.	FROM OEM or substantially equivalent make
System integrator	The contractor should have sufficient experience in the relevant field of design, supply, installation, commissioning and maintenance works of corresponding system
CAT6 Ceiling Connector	Molex/ Legrand/ Amp or substantially equivalent make
CAT6 Patch Cord cable	Molex/ Legrand/ Amp or substantially equivalent make
LIU- IDF	Molex/ Legrand/ Amp or substantially equivalent make
LIU -MDF	Molex/ Legrand/ Amp or substantially equivalent make
Speakers	Honeywell / Bosch / Ateis or substantially equivalent make
Amplifier	Honeywell / Bosch / Ateis or substantially equivalent make

Note: Any change of material from the above accepted brands shall be got approved by the Engineer – in – charge prior to its supply in CSL.

Signature of the Contractor

Construction of multi-storey (G+11) Employees Residential Quarters at Cheriya Kadavanthra
File No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS/2026/2.

List of Tender Drawings		
Sl.No.	Drawing title	Drawing No.
1	Location Plan	CVL/EMP QTRS/ LOC. PLAN/01
2	Site Plan	CVL/EMP QTRS/ SITE PLAN/01
3	Service Plan	CVL/EMP QTRS/ SERVICE PLAN/01
4	Ground Floor Plan	CVL/EMP QTRS/GF PLAN/01
5	Typical Floor Plan	CVL/EMP QTRS/TYPICAL FLOOR PLAN/01
6	Terrace Floor Plan	CVL/EMP QTRS/TERRACE FLOOR PLAN/01
7	Roof Plan	CVL/EMP QTRS/ROOFPLAN/01
8	Elevation	CVL/EMP QTRS/ELEVATION/01
9	Section A-A	CVL/EMP QTRS/SECTION A-A/01
10	General notes (Sheet 1 OF 2)	3152-SD01
11	General notes(Sheet 2 OF 2)	3152-SD01A
12	Layout of columns and piles and details of piles	3152-SD02
13	Layout of pile cap, Grade beams, Base slabs and details of grade beam and base slabs.	3152-SD03
14	Details of Pile caps (Sheet 1 OF 4)	3152-SD04
15	Details of Pile caps (Sheet 2 OF 4)	3152-SD05
16	Details of Pile caps (Sheet 3 OF 4)	3152-SD06
17	Details of Pile caps (Sheet 4 OF 4)	3152-SD07
18	Layout of columns and shear walls-1	3152-SD08
19	Layout of columns and shear wall-2	3152-SD09
20	Layout of columns and shear wall-3	3152-SD10
21	Details of shear wall-1	3152-SD11
22	Details of shear wall-2	3152-SD12
23	Layout and details of staircase-1	3152-SD13
24	Layout and details of staircase-2	3152-SD14
25	Layout of typical floor beams & slabs, Typical details of slabs(1 st to 11 th floor)	3152-SD15
26	Beam details of typical floor 1 st floor to 11 th floor (Sheet 1 OF 3)	3152-SD16

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27	Beam details of typical floor 1 st floor to 11 th floor (Sheet 2 OF 3)	3152-SD17
28	Beam details of typical floor 1 st floor to 11 th floor (Sheet 3 OF 3)	3152-SD18
29	Layout of Terrace floor beam, slabs and details of slabs.	3152-SD19
30	Beam details of Terrace floor (Sheet 1 OF 3)	3152-SD20
31	Beam details of Terrace floor (Sheet 2 OF 3)	3152-SD21
32	Beam details of Terrace floor (Sheet 3 OF 3)	3152-SD22
33	Layout and details of LMR,OHT, stair head room beams and slabs.	3152-SD23
34	Layout and details of Sump tank.	3152-SD24
35	Layout and details of STP tank.	3152-SD25
36	Layout and details of Roof Truss.	3152-SD26
37	UG sump puddle details	CVL/EMP QTRS/UG SUMP PUDDGLE DETAILS/01
38	STP Layout	CVL/EMP QTRS/ STP LAYOUT/01
39	External water supply layout	CVL/EXTERNAL WATER SUPPLY LAYOUT/01
40	External drainage layout	CVL/EXTERNAL DRAINAGE LAYOUT/01
41	External storm water disposal layout	CVL/EXTERNAL STORM WATER LAYOUT/01
42	Stilt floor drainage layout	SRA/2853/PHE/06
43	Typical floor internal drainage layout	SRA/2853/PHE/07
44	Typical floor internal water supply layout	SRA/2853/PHE/08
45	Terrace floor water supply layout	SRA/2853/PHE/09
46	Terrace rainwater disposal layout	SRA/2853/PHE/10
47	Fire protection - Site and service plan	CVL/EMP QTRS/FIRE PROTECTION SERVICE PLAN/01
48	Fire protection - Wet riser & schematic diagram	CVL/EMP QTRS/FIRE PROTECTION SCHEMATIC DIAGRAM/01
49	Fire protection Terrace / Roof Plan	CVL/EMP QTRS/FIRE PROTECTION TERRACE PLAN/01
50	Main SLD (Sheet 1 OF 2)	Sheet-1
51	Main SLD (Sheet 2 OF 2)	Sheet-2
52	Stilt floor electrical drawing	487/SQTRS/AR-01

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53	Terrace floor electrical drawing	487/SQTRS/AR-03
54	Typical floor electrical plan	487/SQTRS/AR-02
55	CCTV drawing	487/SQTRS/AR-01
56	Earthing stilt floor	CEPL-TN-EMPLOYEES QUARTERS-SR-5900
57	Earthing typical floor drawing	CEPL-TN-EMPLOYEES QUARTERS-SR-5900
58	Earthing section drawing	CEPL-TN-EMPLOYEES QUARTERS-SR-5900
59	Earthing terrace floor drawing	CEPL-TN-EMPLOYEES QUARTERS-SR-5900
60	Earthing roof drawing	CEPL-TN-EMPLOYEES QUARTERS-SR-5900

Signature of the Contractor

Annexure-1

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS/2026/2.

CHECK LIST**CONSTRUCTION OF MULTI-STOREY (G+11) EMPLOYEES RESIDENTIAL
QUARTERS AT CHERIYAKADAVANTHRA**

Sl.No	Description	Yes	No
1	Whether the tenderer has completed during the last seven years, ending with the date of submission of tender, works of similar nature described in the NIT costing either one work of value ₹ 38 Crores OR two works of value ₹ 24 Crores each OR three works of value ₹ 19 Crores each.		
2	Whether the tenderer has an average annual turnover of more than ₹14.00 Crores during the preceding 3 years.		
3	Whether the tenderer has enclosed Solvency certificate for an amount not less than ₹ 14.00 Crores from his bankers/ financial institutions.		
4	Whether Special Conditions of this tender has been read and expressly understand fully and considered the same for submitting the bid so that further claims will not be raised by the contractor on that account.		
5	Whether the tenderer has agreed to all terms & conditions given in the tender.		
6	Whether the tenderer has submitted signed certificates as per clause 6 (A) of special conditions of contract.		
7	Whether the tenderer has been blacklisted from any Central / State Govt. Dept/ PSU / Company.		

Documental evidences in proof of 1 to 3 are to be furnished.

Explanatory notes: Similar work(s) means having satisfactorily carried out construction of minimum seven storey building executed in India in a single contract comprising of piling / foundation works, fabrication, superstructure, MEP, firefighting, finishing and all associated civil works.

Sd/-

Deputy General Manager (Civil)

Signature, Name &
Address of Contractor:
Date:

Signature of the Contractor

Annexure-2

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS/2026/2.

SCHEDULE OF COMPLETION**CONSTRUCTION OF MULTI-STOREY (G+11) EMPLOYEES RESIDENTIAL
QUARTERS AT CHERIYAKADAVANTHRA, COCHIN****MILESTONE – I**

Piling, UG Sumps / Foundation / RCC frameworks up to fourth floor roof slab level to be completed in 12 months from the date of start of work.

MILESTONE – II

RCC frame works from forth floor roof slab level to eleventh floor roof slab level to be completed in 10 months from the date of completion of Milestone-I.

MILESTONE – III

Balance work to be completed in 8 months from the date of completion of milestone II.

Sd/-

Deputy General Manager (Civil)

**Name, Address &
Signature of
Contractor:**

Signature of the Contractor

Annexure-3**Details of Bidders**

Name of work: Construction of multi-storey (G+11) employees residential quarters at Cheriyakadavanthra.

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS/2026/2.

1. Name of bidder : -
2. Address of bidder : -
.....
3. Contact Tel number :-
4. e-mail address :-
5. PAN No : -
6. GST Reg. No. :-
7. ESI/PF Reg. No. :-
8. Others :-.....

Date:

Signature of the bidder

Signature of the Contractor

Annexure-4

(Annexure-4 should be submitted in the letter head of contractor/firm)

BID SECURITY UNDERTAKING

Name of work :- Construction of multi-storey (G+11) employees residential quarters at
Cheriyakadavanthra.

Tender No :- CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS/2026/2.

1. I/We hereby undertake the acceptance of all the terms and conditions of the tender including the price agreed by me and in case if I/We withdraw or modify our bid during the period of validity or if I/we fail to sign the contract before the deadline defined in the bid or fail to commence and progress the work as the tender terms and time provided in the bid, I agree to abide by the cancelation of my contract with CSL and administrative action including black listing of my firm from future business with CSL.
2. "I/We hereby confirm that I have read and understood the general conditions of contract, special conditions, tender schedule, drawings, terms and conditions issued in the tender. Clarifications obtained wherever required, and understood the scope of work fully and accordingly the rates are worked out for tender".
3. I/We hereby undertake the following:
 - A. "I/We hereby confirm that I/we am/are acquainted with the site location and site condition, nature of work, schedule of completion, plant and machinery, personnel requirement, quality requirements, specification, safety requirements etc.
 - B. I/we hereby confirm and affirm that all statutory requirements as relevant to laws of the country will be fulfilled by me/us in all respects in this work if the work is awarded.
 - C. I have read and understood the special conditions of contract which describes site restrictions and work condition and willing to work as per terms and conditions.
 - D. I/we hereby affirm and certified that I /we am /are fully aware about the tender conditions in full including the operational requirements of M/s Cochin Shipyard Ltd., and hereby affirm and certify that entire tender conditions will be complied by me/us in all respects and complete the work accordingly if awarded.

Date:

Name of Contractor/Firm
(Official seal of the company)

Signature of Contractor/Firm

Signature of the Contractor

Annexure-5**GST UNDERTAKING**

Name of work : Construction of multi-storey (G+11) employees residential quarters at Cheriyakadavanthra.

Tender No : CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS/2026/2.

1. "I / WE HAVE GONE THROUGH THE TENDER, TERMS AND CONDITIONS, GCC AND ACCEPT THE SAME AND DECLARE THAT THE RATES QUOTED AS BASIC RATES AND GST SEPERATELY AND NO ADDITIONAL CLAIM WILL BE RAISED FOR ANY OTHER STATUTORY RECOVERIES TO BE BORNE BY ME. I / WE ALSO CONFIRM THAT COVER B (PRICE BID) DO NOT CONTAIN ANY CONDITIONS".
2. "I / WE HAVE NOT MADE ANY PAYMENT OR ILLEGAL GRATIFICATION TO ANY PERSON/AUTHORITY CONNECTED WITH THE BID PROCESS SO AS TO INFLUENCE THE BID PROCESS AND HAVE NOT COMMITTED ANY OFFENCE UNDER THE PC ACT IN CONNECTION WITH THE BID".

Signature:

Name & address of the contractor

Signature of the Contractor

Annexure-6**Electronic Payment Mandate Form***(Mandate for receiving payments through NEFT Cochin Shipyard Ltd.)*

(Please enclose a cancelled un-signed cheque leaf to enable us to verify the details mentioned above)

We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or lost because of incomplete or incorrect information, we would not hold the company

1) Vendor/ Contractor Name :

2) Vendor/ Contractor Address :

3) Vendor Code :

4) Permanent Account Number (PAN) :

5) Particulars of Bank Account :

a. Name of the Bank :

b. Name of the Branch :

c. NEFT/IFS Code of the Bank :

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d. Branch Code :

e. City Name :

f. Branch Location :

g. Branch Telephone No. :

h. 9-Digit MICR Code :

i. Type of Account (S.B, Current or Cash Credit) with code (010/011/013) :

--	--	--

j. Account Number (as appearing on the cheque book) :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

6) Email Address of Vendor :

7) Date of Effect of RTGS/ NEFT in your Bank :

Signature of the Contractor

responsible

(.....)
Signature of Vendor

Bank Certificate

We certify that _____ has an Account No.
_____ with us and we confirm that the details given above are correct as per
our records.

Date:

Place:

(.....)
Authorized official of Bank

Signature of the Contractor

Annexure-7**Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

PROFORMA OF SCHEDULES

- | | |
|--|-------------------------------------|
| 1. Cost of tender | : Nil |
| 2. EMD | : ₹57,80,000/- |
| 3. Time allowed for execution of work. | : 30 months |
| 4. Number of days from the date of work order
for reckoning date of start | : 14 days. |
| 5. Period of defect liability | : 2 years |
| 6. Issue of electricity and water by CSL | : NA (To be arranged by contractor) |
| 7. Escalation available | : For steel |
| 8. Schedule of materials issued free of cost. | |

Sl.No	Description of item	Quantity	Place of Issue	Remarks
1	2	3	4	5

9. Schedule of machineries and tools issued free.

Sl. No	Description	Place of Issue	Remarks
1	2	3	4

Signature of the Contractor

Annexure-8

Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra
Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS
/2026/2.

Undertaking by the bidders

I/We have read and examined the Notice Inviting Tender, Tender Schedule, Specifications, Drawings & Designs, General rules, Conditions & Clauses of Contract, Special Conditions, Safety/Security rules, integrity pact etc and Act/ Rules referred to in the General Conditions of Contract and all other contents in the Tender Document for this work.

I/We hereby tender for the execution of the work specified in the schedule of quantities and in accordance with the specifications, designs, drawing and instructions in writing, General Conditions of Contract, approved materials etc.

I/We agree to keep the tender open for ninety (90)* days from the due date of its opening unless otherwise specified in the NIT.

(* The validity period of the tender shall be modified (if required) as per requirement.)

The EMD is hereby forwarded in fixed deposit receipt of a scheduled bank (pledged in favour of CSL)/demand draft of a scheduled bank/bank guarantee issued by a scheduled bank as Earnest Money **(strike out as the case may be)**.

A copy of fixed deposit receipt of scheduled bank/demand draft of a scheduled bank/bank guarantee issued by a scheduled bank, furnished as Earnest Money is scanned and uploaded **(for e-tender only and strike out as the case may be)**.

If I/We, fail to furnish the prescribed Performance Guarantee within prescribed period, I/We agree that CSL shall without prejudice to any other right or remedy, be at liberty to forfeit the said Earnest Money absolutely. Further, if I/We fail to commence work as specified, I/We agree that CSL shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said Performance Guarantee absolutely. The said Performance Guarantee shall be a guarantee to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provisions contained in the tender.

Signature of the Contractor

Further, I/We agree that in case of forfeiture of Earnest Money or Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process and future tenders in CSL.

I/We undertake and confirm that eligible similar works furnished for the prequalification has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of CSL, then I/We shall be debarred for tendering in CSL in future. Also, if such a violation comes to the notice of CSL before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

I/We hereby declare that I/We shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information/derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety/security of CSL and CSL activities.

Dated:

Signature of Contractor

Postal Address:

Email ID:

Telephone No:

Signature of the Contractor

Annexure-9

PROCEDURE TO BE FOLLOWED FOR OBTAINING ENTRY PASS
FOR CONTRACT WORKER

1. Issue of Work Order by the concerned Department.
2. The contractor / Firm shall submit following documents required for entry to CSL work site:
 - a) CONTRACTOR BIO DATA
 - a. A copy of the list along with following other documents shall be produced.
 - Contractor's letter (Request for New Pass) with name of Workers, recommended by concerned Officer.
 - ESI declaration/ Personal data Form.
 - Age Proof Certificate (School certificate or valid Indian Passport) if requested
 - Savings A/c Pass Book with IFS Code
 - Adhaar
 - Election ID
 - Copy of Employees Compensation Policy
3. Modification of the procedure without any intimation, in short notices is also possible.

Dated:

Signature of Contractor

Signature of the Contractor

Annexure-10**PRE CONTRACT INTEGRITY PACT****General**

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on day of the month of, between Cochin Shipyard Ltd (CSL), A Government of India Enterprise under the Ministry of Ports, Shipping & Water Ways having its registered office at Cochin, Kerala, India (hereinafter called the “PRINCIPAL”) of the First part and M/s.....(hereinafter called the “BIDDER/Seller”) of the second part. WHEREAS the PRINCIPAL proposes to procure..... and the BIDDER/Seller is willing to offer/has offered the stores and WHEREAS the BIDDER is a private company / public company / Government undertaking / partnership/registered export agency, constituted in accordance with the relevant law in the matter and the PRINCIPAL is a Government of India Enterprise.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:- Enabling the PRINCIPAL to obtain the desired said stores/equipment/item at a competition price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and Enabling BIDDERS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:-

Commitments of the PRINCIPAL

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

1.2 The PRINCIPAL will, during the pre-contract stage, treat all BIDDERS alike and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.

Signature of the Contractor

1.3 The officials of the PRINCIPAL will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2 In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the PRINCIPAL with full and verifiable facts and the same is prima facie found to be correct by the PRINCIPAL, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the PRINCIPAL and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the PRINCIPAL the proceedings under the contract would not be stalled.

3. Commitments of BIDDERS

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:-

3.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the PRINCIPAL, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

3.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the PRINCIPAL or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract of any other contract with the government for showing or forbearing to show favour or disfavor to any person in relation to the contract of any other contract with the Government.

3.3 BIDDERS of foreign origin shall disclose the name and address of their Indian agents and representatives, if any and Indian BIDDERS shall disclose their foreign principals or associates, if any, in the bid.

3.4 BIDDERS shall disclose the payments to be made by them to their Indian agents/brokers or any other intermediary, in connection with this bid/contract in the bid and the payments have to be in Indian Rupees only.

3.5 The BIDDER further confirms and declares to the PRINCIPAL that the BIDDER is the original manufacturer/ integrator/authorized agent of the stores/equipment/items and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the PRINCIPAL or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount

Signature of the Contractor

been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

3.6 The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the PRINCIPAL or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

3.7 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

3.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9 The BIDDER shall not use improperly, for purposes of competition or personal gain, pass on to others, any information provided by the PRINCIPAL as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

3.10 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11 The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12 If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the PRINCIPAL, or alternatively, if any relative of an officer of the PRINCIPAL has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender. The term 'relative' for this purpose would be as defined in section 6 of the Companies Act 1956.

3.13 The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee or the PRINCIPAL.

4. Previous Transgression

4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify; BIDDER's exclusion from the tender process.

4.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Signature of the Contractor

5. Earnest Money (Security Deposit)

5.1 While submitting commercial bid, the BIDDER shall deposit an amount **NIL** (to be specified in RFP) as Earnest Money as applicable/Security Deposit, with the PRINCIPAL through any of the following instruments:

- (i) Bank Draft of Pay Order in favor of CSL.
- (ii) A confirmed guarantee by an Indian Nationalized Bank, promising payment of the guaranteed sum to the PRINCIPAL on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the PRINCIPAL shall be treated as conclusive proof of payment.
- (iii) Any other mode or through any other instrument (to be specified in the RFP).

5.2 The Earnest Money if applicable/Security Deposit shall be valid upto the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the PRINCIPAL, including warranty period.

5.3 In case of the successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of sanctions for Violation shall be applicable for forfeiture of Performance Bond in case of a decision by the PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.4 No interest shall be payable by the PRINCIPAL to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

6 Sanctions for Violations

6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the PRINCIPAL to take all or any one of the following actions, wherever required:-

- (i) To immediately call off the pre contract negotiations without assigning any reason or giving any; compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.
- (ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/ Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the PRINCIPAL and the PRINCIPAL shall not be required to assign any reason therefore.
- (iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.
- (iv) To recover all sums already paid by the PRINCIPAL, and in the case of an Indian BIDDER with interest thereon at 2% above the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% above the LIBOR (London Inter Bank Offer Rate). If any outstanding payment is due to the BIDDER from the PRINCIPAL in connection with any other contract

Signature of the Contractor

for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the PRINCIPAL, along with interest.

(vi) To cancel all or any other contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the PRINCIPAL resulting from such cancellation / recession and the PRINCIPAL shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

(vii) To debar the BIDDER from participating in the future bidding processes of CSL for a minimum period as deemed appropriate, which may be further extended at the discretion of the PRINCIPAL.

(viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the PRINCIPAL with the BIDDER, the same shall not be opened.

(x) Forfeiture of Performance Bond in case of a decision by the PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this pact.

6.2 The PRINCIPAL will be entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the PRINCIPAL to the effect that a breach of the provisions of this pact has been committed by the BIDDER shall be binding on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes of this Pact.

7 Fall Clause

7.1 The BIDDER undertakes that it has not supplied/is not supplying similar product/systems/items or subsystems at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar product/systems or sub systems/items was supplied by the BIDDER to any other Ministry/Department of the Government of India or PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the PRINCIPAL, if the contract has already been concluded.

8 Independent Monitors

8.1 The PRINCIPAL has appointed Independent Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission.

Signature of the Contractor

1) Dr. Rajan S Katoch, IAS (Retd)
A-91, Alkapuri, Bhopal (MP) - 462022.
Mobile: 8800919222; Email: rkatoch@nic.in

2) Dr. Vinod Bihari Mathur, IFoS (Retd.)
D302, Arborea Luxury Homes,
Tarla Nagal, Near Doon Helidrome,
Dehradun, Uttarakhand – 248001.
Mobile: 9412054648; Email: ybm.ddn@gmail.com

8.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

8.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

8.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings.

8.5 As soon as the Monitors notices, or has reason to believe, a violation of this pact, he will so inform the Authority designated by the PRINCIPAL.

8.6 The PRINCIPAL accepts that the Monitors have the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitors, upon his request and demonstration of a valid interest, unlimited access to his project documentation. The same is applicable to Subcontractors. The Monitors shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

8.7 The PRINCIPAL will provide to the Monitors sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitors the option to participate in such meetings.

8.8 The Monitors will submit a written report to the designated Authority of PRINCIPAL /Secretary in the Department/ within 8 to 10 weeks from the date of reference or intimation to him by the PRINCIPAL /BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

9 Facilitation of Investigation

In case of any allegation of violation of any provisions of this pact or payment of commission, the PRINCIPAL or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER. The BIDDER shall provide necessary information and documents in English and shall extend all possible help of the purpose of such examination/inspection.

Signature of the Contractor

10 Law and Place of Jurisdiction

10.1 This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the PRINCIPAL.

10.2 A person signing Integrity Pact shall not approach the Courts while representing the matters to Independent External Monitors and shall await their decision in the matter.

11 Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extent law in force relating to any civil or criminal proceedings.

12 Validity

12.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the contract to the satisfaction of both the PRINCIPAL and the BIDDER/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

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

13 The parties hereby sign this Integrity Pact aton

For & on behalf of PRINCIPAL
Cochin Shipyard Limited Office Seal)
Witness

1.....
2.....

For & on behalf of BIDDER
(Office Seal)
Witness

1.....
2.....

* Provisions of these clauses would need to be amended/deleted in line with the policy of the BUYER in regard to involvement of Indian agents of foreign suppliers.

Signature of the Contractor

Annexure-11**BANK GUARANTEE IN LIEU OF EMD****(On stamp paper value Rs. 200/-**

To

COCHIN SHIPYARD LTD

(GOVT. OF INDIA ENTERPRISE.)

PO BAG No. 1653, PERUMANOOR PO, COCHIN 682 015.

This deed of Guarantee made on..... Day of..... Two Thousand..... (Name and address of the bank) of the between CSL on one part and other part is as follows:

In consideration of CSL having allowed M/s..... (herein after referred to as 'the Contractor') to submit Tender No.....without Earnest Money according to the conditions of such Tender Notification, we... (Name of the Bank) (hereinafter referred to as 'the bank') undertake to pay to CSL on demand the sum of money payable as Earnest Money in respect of the Tender Number.....made by the contractor in case the contractor withdraws from the tender before the date of firmness stipulated or when the tender is accepted by CSL, the contractor makes default in furnishing the Security Deposit or in entering into an agreement as required by CSL or otherwise commits any breach of the terms and conditions of the tender.

We, the bank, hereby irrevocably undertake to pay you any amount not exceeding in total the Guarantee Amount upon receipt by us of your demand in writing accompanied by the following documents:

1. Your signed statement certifying that the Contractor is in breach of his obligation(s) under the Contract and the respect in which the Contractor is in breach

Any demand for payment should contain your authorized signatures which must be authorized by your bankers or by a notary public.

The guarantee shall remain in full force and effect during the period that would be taken for the finalization of the tender and till CSL certifies that the terms and conditions of the said tender have been fully and properly carried out by the said contractor and accordingly discharges this guarantee or for 6 months from the date of issue of this guarantee whichever is earlier. A notice of

Signature of the Contractor

the claim under this guarantee may be served on the bank within 3 months after the said period in which case the same shall be enforceable.

We, the Bank, further agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder This guarantee shall not be avoided, released or affected by any variation in the terms of the tender, acceptance of the contract between the contractor and CSL or any neglect, indulgence or forbearance by CSL

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed.....only.
2. This Bank Guarantee shall be valid up to..... (date) (9 months from the date of issuing the BG) and
3. We are liable to pay the guaranteed amount or any part thereof under this bank guarantee only and only if you serve upon us a written claim or demand on or before..... (validity date).

Any demand for payment under this Guarantee must be received by us at this office during working hours on or before the validity Date Should we receive no claim from you by the validity Date, our liability to you will cease and the guarantee will definitely become null and void whether returned to us or not.

Yours truly.

Signature and seal of the

Guarantor:.....

Name of Bank:.....

Address:.....

Date:.....

Signature of the Contractor

Annexure-12

Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra
Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS
/2026/2.

PROFORMA OF POWER OF ATTORNEY / LETTER OF AUTHORITY

To,
Deputy General Manager (Civil),
Cochin Shipyard Ltd.,
Cochin- 682015

Dear Sir,

We _____ do
hereby confirm that Mr./Ms./Messrs _____
(Name and Address) is/are authorized to represent us to bid, negotiate and conclude on our behalf
with you against Tender No. -----

We confirm that we shall be bound by all and whatsoever our agents shall commit.
Yours faithfully,

Signature:
Name and Designation:

For & on behalf of: Signature, name and seal of the certifying authority

Signature of the Contractor

Annexure-13

REWARDS AND REPRIMANTS –SAFETY

1A	PPE - Rewards	
	Type of Noteworthy actions	Sub-Contractors
	Promoting use of Job Specific PPEs.	Reward during monthly PEP talk by presenting small gifts/ certificates of appreciation decided by HoD.
	Introduction of new PPE specific to the job/ area.	Recommend for Yearly HSE Rewards as decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
1B	PPE - Reprimand	
	Type of Deviations	Sub-Contractors
	Nonuse of basic PPES / Nonuse of job specific PPEs / Use of Damaged PPEs	a. Observation of Deviation The concerned sub-contractor shall brief the defaulter the need for wearing PPEs and enforce the same. If any deviation noticed by CSL, violation form(V/I FORM)shall be issued by Executing Officer/S&F Dept. and impose a fine of ₹10,000.00 on the contractor and conduct safety Briefing by the respective Officer/ Supervisor.
		b. Incident due to non compliance. Issue form (V/I FORM) by Executing Officer/HoD/S&F Dept. to the contractor. The registration of firm(s) involved shall be suspended by Executing Officer/HoD and entry pass issued to the workers involved shall also be cancelled. HoD shall issue show cause notice to the contractor and if the explanation by the contractor is unsatisfactory, contract registration shall be cancelled or suspension of registration can be revoked by imposing a fine of ₹1,00,000/-
1C	Administrative Controls – Rewards	
	Type of Noteworthy actions	Sub-Contractors
	Exemplary work on Safety	Safety employee of the month shall be decided by the HoD. A small gifts/ certificates of appreciation will be presented by HoD.
	Introduction of new methods/actions for	Recommend for safety award of the year decided by a committee consisting of Occupier, Factory

Signature of the Contractor

	creating a safe work area.	Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
	Best performing FSR	Best FSR of the month/quarter decided by HoD.
		Best FSR Award of the year decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
2B	Administrative Controls - Reprimand	
	Type of Deviations	Sub-Contractors
	Category 1 Deviation (High potential) / Category 2 Deviation (Medium potential) / Category 3 Deviation (Low potential)	<p>a. Observation of Deviation</p> <p>The concerned sub-contractor shall brief the defaulter the need for adhering to SOPs and enforce the same.</p> <p>Issue form (V/I FORM) by S&F Dept/Executing Officer and impose a fine for ₹25,000/- for Category 1, ₹10,000/- for Category 2 and ₹5000/- for Category 3 deviations.</p> <p>Conduct Mass Safety Briefing by the respective AGM within two days for sub-contractors supervisors & their workers. Works shall be suspended till the payment of fine in case of Category 1 Deviation.</p>
		<p>b. Incident due to non-compliance.</p> <p>Issue form (V/I FORM) by Executing Officer/HoD/S&F Dept. to the contractor. The registration of firm(s) involved shall be suspended or cancellation of registration from CSL decided by Executing Officer/HoD and entry pass issued to the workers involved shall also be cancelled. HoD shall issue show cause to contractor. If explanation is unsatisfactory, contract registration shall be cancelled or suspension can be revoked by imposing a fine of ₹1,00,000.00. Recurrence of the same deviation will entail cancellation of contract registration.</p>
2C	(Pls see the Annexure-A – Type of Category 1,2,3 Deviations)	
4B	Elimination-> Physically remove the hazards, Net zero initiatives, introduce new excellence models, 6S & 5R models etc	

Signature of the Contractor

अनुलग्नक / Annexure A – विचलनों का प्रकार / Type of Deviations

Category 1 Deviation (High potential)	Category 2 Deviation (Medium Potential)	Category 3 Deviation (Low Potential)
1. Work Permit / NCS Violations a. Performing work without valid permit / NCS b. Deviating from approved PTW/ JSA	1. Failure to observe safety signboards 2. Failure to provide life buoys or life jackets when working near or over water. 3. Not switched off Equipment's/machineries after use 4. Throwing or dumping of hazardous materials to work spaces/environment 5. Overloading or improper use of lifting appliance / equipment. 6. Placing / leaving materials on scaffolds. 7. Tampering with electrical fitting or appliances 8. Throwing or dropping objects from heights 9. Improper use of ladders or platforms 10. Use of unsafe tools, machinery or equipment in the yard. 11. Unauthorized use of yard's equipment in the yard 12. Unsafe use of cylinders 13. Working without Basic and Job Specific PPEs 14. Use of non tested eyes hooks or eye hooks without round weld 15. Use of Extended loads without red flag and Banksman with Florescent jacket 16. Failure to used proper electrical plugs / connectors (eg. Heavy duty industrial type). 17. Failure to maintain proper housekeeping at skids/shops/onboard vessel – for Supervisor/Sub-con/Project Manager/Officer in charge of vessel 18. Deviation of SOP(General)	1. Parking bicycle / vehicle in prohibited areas 2. Jaywalking 3. Not deployed safety officers by the firm as per the norm. Fine per day basis 4. Contractors not submitted the revised HSE plan in January of every year those who employees 20 and more workers 5. No tags on the tested items If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Dept
2. Safe to Work Certifications a. Unauthorized entry into confined spaces or compartments b. Using unsafe or not certified scaffold.		
3. Violation relating to Gas Mgmt a. Gas leaks Down Stream b. Gas leaks Up Stream c. Gas management system – Down Stream d. Gas management system – Up Stream		
4. Violations relating to tools and equipment's a. Use of untested hoses and electrical tools/Equipment's b. Substandard use of Electrical Fittings/connections c. Violation of Statutory requirements – Lifting tools and tackles etc		
a. Unsafe work methods b. Fishing from dock and quays c. Unsafe lifting methods d. Dangerous or rash act likely to cause serious injury to himself or others e. Use of 230 V hand lamp f. Driving / Cycling using mobile Phone g. Dangerous or unsafe driving h. Driving vehicles more than 20 Km/hr i. Failure to provide guard rails, fencing or cover to prevent falling of persons j. No guards and handle on		

Signature of the Contractor

Category 1 Deviation (High potential)	Category 2 Deviation (Medium Potential)	Category 3 Deviation (Low Potential)
<p>grinding machine, failure to use guards</p> <p>k. Unauthorised use of equipment's/ vehicles</p> <p>l. Unsafe movement of material handling equipments.</p>	<p>If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Dept</p>	
<p>5. Unsafe Behaviours</p> <p>a. Tampering with fire protection / rescue equipment / Safety systems</p> <p>b. Failure to comply with safety instruction /advice from supervisor or Superiors / S&F staff</p> <p>c. Failure to Instruct and Comply SOPs by the Supervisor</p> <p>d. Willfully causing to himself any illness, injury or disability</p> <p>e. Smoking inside CSL</p>		
<p>If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Dept</p>		

Signature of the Contractor

Annexure-14**Construction of multi-storey (G+11) residential employees quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

LIST OF KEY PERSONNEL FOR THE EXECUTION OF WORK

Sl No.	Name	Designation	Qualification	Experience

The details of experience of each candidate shall be attached in separate sheets along with this annexure.

Signature of Contractor

Signature of the Contractor

Annexure-15

Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

CANDIDATE SUMMARY

Name of Applicant			
Position		Candidate	
		Prime <input type="checkbox"/>	Alternate <input type="checkbox"/>
Candidate Information	Name of Candidate		
	Date of Birth		
	Professional Qualification		
Present Employment	Name of Employer		
	Address of Employer		
	Contact Officer		
	Telephone & Fax No.		
	Job Title of Candidate		
	Years with present Employer		

Summarise Professional Experience over the last 20 years, in reverse chronological order. Indicate particulars of technical and managerial experience relevant to the project.

From	To	Company/Project/Position/relevant Technical and Managerial Experience

Signature of the Contractor

Annexure-16**Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

**LIST OF PLANT, EQUIPMENT/MACHINERY /LAB TESTING EQUIPMENTS OWNED BY
THE COMPANY AND TO BE USED IN THIS WORK**

Description of Equipment/ Machinery	Make	Year of Manufacture	Capacity

Signature of Tenderer

Signature of the Contractor

Annexure-17**Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

**CRITERIA FOR EVALUATION OF THE PERFORMANCE OF CONTRACTORS FOR
PRE-QUALIFICATION**

	Attributes	Evaluation
(a)	Financial strength (Max. 30 marks)	
	i. Average annual turnover 25marks ii. Financial Capability 5marks	I. 60% marks for minimum eligibility criteria II. 100% marks for twice the minimum eligibility criteria or more In between (1) & (2) on pro-rata basis
(b)	Experience in similar class of works (Max. 40 marks)	
		I. 60% marks for minimum eligibility criteria II. 100% marks for twice the minimum eligibility criteria or more In between (1) & (2) on pro-rata basis
(C)	Personnel and Establishment (Max. 15 marks)	
	1. Graduate Engineer 3 marks for each up to Max. 6 marks 2. Diploma holder Engineer 2 marks for each up to Max. 5 marks 3. ITI Supervisor /Foreman 1 marks for each up to Max. 4 marks	
(d)	Plant & Equipments (Max. 15 marks)	

Signature of the Contractor

1. Concrete Batch mixer	1 mark for each up to Max. 2 marks
2. Truck/Tippers/Transit mixer/Tanker	1 mark for each up to Max. 2 marks
3. Steel shuttering	1 mark for each 800sqm up to Max.2 marks
4. Material Hoist	1 mark for each up to Max. 2 marks
5. Excavator/JCB/Bulldozer	1 mark for each up to Max. 2 marks
6. Pile Rig	1 mark for each up to Max. 2 marks
7. Vibration Compactor	1 mark for each up to Max. 1 marks
8. Lab testing equipments	1 mark for each up to Max. 2 marks

Signature of the Contractor

Annexure-18**Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS
/2026/2.

ANNUAL FINANCIAL TURNOVER

Name of Bidder:

Sl. No.	Financial Year	Turnover
1.		
2.		
3.		

Date :

Signature of Contractor

Note: Attach attested documents of P&L / Balance Sheet as documental evidence.

Signature of the Contractor

Annexure-19

Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS
/2026/2.

SOLVENCY CERTIFICATE

Solvency Certificate to be enclosed received from Banker / Financial Institutions

Signature of the Contractor

Annexure-20

**PROFORMA OF BANK GUARANTEE FOR PERFORMANCE GUARANTEE / SECURITY
DEPOSIT**

(On stamp paper of value Rs. 200/-)

Guarantee No.....

Amount of Guarantee `

Guarantee Cover From.....

Last Date of Lodgment of Claim.....

1. In consideration of the Cochin Shipyard Limited (hereinafter called CSL) having agreed to exempt.....(hereinafter called “The said Contractor(s)” from the demand, under the terms and condition of an Agreement between CSL and for the execution of the work of “**Construction of New Multi-Storey (G+11) Employees Residential Quarters at Cheriya Kadavanthra**” as per work order No. dated..... (hereinafter called “the said agreement”) of Security Deposit for the due fulfillment by the said contractor(s) of the terms and conditions contained in the said agreement, on production of a Bank Guarantee for ` (Rupees.....only) We..... (*Name of Bank*) (hereinafter referred to as “the Bank”) at the request of CSL do hereby undertake to pay to CSL an amount not exceeding ` (Rupeesonly) on demand.

2. We (*name of bank*)..... do hereby unconditionally and irrevocably undertake to pay CSL to the extent of `...../-(Rupees.....Only) without any demur merely on a demand from CSL stating that the amount claimed is due by way of loss or damage caused to or suffered by the CSL by reason of breach by the Contractor of any of the terms and conditions contained in the said contract. Any such demand made to the (*name of bank*)..... shall be conclusive as regards to the amount due payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding `..... (Rupees..... Only)

3. Our liability under this present guarantee is absolute and unequivocal and we undertake to pay CSL the amount so demanded without seeking the consent of the Contractor and notwithstanding

Signature of the Contractor

the raising any dispute and/or disputes or filing any suit or proceeding before any court or tribunal Authority. The payment so made by us under this guarantee shall be a valid discharge of our liability for payment here under and the Contractor shall have no claim against us for making such payment.

4. Notwithstanding anything to the contrary, CSL's decision as to whether the Contractor has made any default or defaults and the amounts to which CSL is entitled by reason therefore shall be binding on us and we shall not be entitled to ask the CSL to establish the claims under the guarantee but will pay the same on demand without objection.

5. We, *(name of bank)*.....further agree that the guarantee herein contained shall remain in full force and effect during the periods that would be taken for the performance of the said contract and that it shall continue to be enforceable till all the dues of CSL under or by virtue of the said contract have been fully paid and its claims satisfied or discharged and till CSL certifies that the terms and conditions of the said contract have been fully and properly carried out by the said contractor and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or beforewe shall be discharged from all liability under this guarantee thereafter.

6. This guarantee shall not be recoverable by us except with the written consent of CSL and shall continue to be enforceable till should it be necessary to extend this guarantee beyond the said date. We undertake to extend the validity of this guarantee beyond the said date, for such further period as may be required by CSL, subject to CSL giving in writing to Contractor the request for extension, and such extension shall be given before the expiry of the forthwith become payable to CSL, notwithstanding that the contract is continuing and/or CSL has or has not terminated the contract or preferred any claim against the Contractor.

7. We *(name of bank)*..... further agree with CSL that, CSL shall have the fullest liberty without our consent and without affecting any manner our obligations hereunder to vary any of the terms and conditions of the said contract or to extend the time of guarantee by the said Contractor from time to time or to postpone for any time or from time to time exercise any of the powers exercisable by CSL against the said Contractor and to forebear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or any

Signature of the Contractor

indulgence which under the law relating to sureties, would but for this provision, have effect of so relieving us.

8. This guarantee shall not in any way be affected due to change in our constitution or by your taking or varying or giving up any securities from the Contractor or any other person, firm or CSL on its behalf or by change in the constitution, winding up, dissolution, insolvency or death as the case may be of the contractor.

9. In order to give full effect to the Guarantee herein contained you shall be entitled to act as if we are your principal debtors in respect of all your claims against the contractor hereby guaranteed by us as aforesaid and we here by expressly waive all our right of suretyship and other rights if any which are in any way inconsistent with the above or any other provisions of this guarantee.

10. We, (*name of bank*)..... also undertake not to revoke this guarantee during its currency except with the previous consent of CSL in writing.

11. Notwithstanding anything contained herein above:

- a. Our Liability under this guarantee shall not exceed `...../-(`Only).
- b. This Bank Guarantee shall be valid up to and including and
- c. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before the expiry of this Guarantee.

Dated theday of.....

SIGNATURE AND SEAL OF BANK

FULL ADDRESS OF THE BANK

Signature of the Contractor

Annexure-21**Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra**

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

LIST OF INSTRUMENTS AND EQUIPMENTS FOR FIELD TESTING LABORATORY**Part-A (1 Mark)****1. Balances**

- i) 7 KG capacity or more, semi-self indicating type
- ii) 500G capacity, semi-self indicating type
- iii) Pan Balance- 5KG capacity

2. Standard Sieves:

- i) I.S. sieves - 300mm dia, of sizes 40 mm, 25 mm, 20mm, 16mm, 12.5 mm, 10 mm, 4.75mm complete with lid and pan.
- ii) I.S. sieves- 200mm (brass frame) consisting of 4.75mm, 2.36mm, 1.18mm, 600 microns, 300microns, 150 microns, 90 microns, 75 microns with lid and pan.

3. Equipment for slump test- Slump cone, steel plate, tamping rod, steel scale.**4. Graduated measuring cylinders 200 ml capacity****5. Measuring tapes - 30 m, 5m, 3m.****6. Vernier caliper****7. Plumb Bob****8. Spirit levels****9. Concrete cube moulds – 15 x 15 x 15 cm – 18Nos. (more numbers as per concrete volume to be arranged).****10. Standard Dumpy Level with Staff.****Part-B (1 Mark)****1. 200 T Compression Testing Machine – 1No. hydraulic / motorized as per IS 14858 (valid calibration certificate required).**

Signature of the Contractor

Work Experience Record

Name of Work: Construction of multi-storey (G+11) employees residential quarters at Cheriya Kadavanthra

Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES QUARTERS /2026/2.

Name of Bidder: _____

Sl. No.	Name & Location of Project	Owner's address including telex fax no. with contact person	Executed value of contract	Duration of Contract			Details of work including major items of work involved	Reference No & Date of letter of intent & completion certificate to be enclosed
				Commencement Date	Scheduled completion date	Actual completion date		
1	2	3	4	5	6	7	8	9
1.								
2.								
3.								

Note:

1. Bidder to Enclose work order and completion certificate issued by the owner, duly certified by a Gazetted officer or equivalent certifying authority. For works undertaken at Cochin Shipyard Ltd, copy of work order and last paid bill can be submitted as documental evidence.
2. In case of experience certificate obtained from other than Government organizations, the same shall be supported with TDS certificate for the completed value

PROGRAM CHART											Annexure-23	
Construction of New Multi-Storey (G+11) Employees Residential Quarters at Cheriya Kadavanthra												
Mile Stone No.	Description of work	Month	Month	Month	Month	Month	Month	Month	Month	Month	Month	Month
1	Site clearance with building/ tree removal and barricading											
2	Foundation work up to plinth level											
3	Structural works											
4	Electrical , AC, Plumbing, Lighting Fixtures fitting and Interior work											
5	Finishing works											
6	Cleaning and clearing the site											

Note: The above sample format can be changes/ detailed BY the bidder accordingly.

Signature of the Contractor

**Construction of multi-storey (G+11) employees residential quarters at
Cheriyakadavanthra**

**Tender No: CSL/CIVIL/SUB DIVISION-IV/CAP.PROP & APPR/G+11 EMPLOYEES
QUARTERS /2026/2.**

QUALITY ASSURANCE PLAN

N o	DESCRIPTION OF MATERIALS	TEST	REFERENCE CODE FOR TESTING	FIELD / LAB TEST	FREQUENCY OF TESTING
1	Cement	Physical & Chemical Properties	IS:4031	Lab	Initial Test- 01 test. Subsequently, 01 test for each 50 MT or part thereof for each brand. Each lot should be accompanied by manufacture's test certificate.
2	Reinforce ment steel	Physical & Chemical Properties	IS:1786	Lab	Initial Test- 01 test for each brand and each dia of reinforcement steel, Subsequently, One test for every 25 MT. Each lot should be accompanied by manufacture's test certificate.
3	Water	PH value, chlorides, sulphates, alkalinity test, acidity test, suspended matter, organic matter and inorganic matter	IS:3025	Lab	Initial Test- Source approval at commencement of work and Subsequently- every six months or change of source.
4	Coarse	Gradation	IS:2386- I	Field /	Minimum one test

Signature of the Contractor

	Aggregate	Deleterious materials	IS:2386- II	Lab	for every 50 cum or part thereof.
		Specific Gravity	IS:2386- III		
		Crushing value	IS:2386- IV		
		Impact value	IS:2386- IV		
		10 % fine value	IS:2386- IV		
5	Fine Aggregate	Organic impurities		Field	Minimum one test for every 20 cum or part thereof.
		Silt content		Field	
		Bulking of Sand		Field / Lab	
		Gradation		Field	
6	Slump Test			Field	Minimum one test for every RCC above 1 cum
7	Cube Test	7 days and 28 days compressive strength	IS:516, IS:456	Lab	1-5 cum Concrete- 1 set of cubes. 6-15 cum Concrete – 2 sets of cubes. 16 & above cum Concrete - 3 sets of cubes, one additional set for 7 day testing.
8	Burned clay Bricks	Dimension		Lab	Minimum one test for every 20000 bricks as part thereof.
		Compressive strength			
		Water Absorption.			
9	Solid cement concrete block	Dimension		Lab	Minimum one test for every 20000 solid blocks as part thereof.
		Compressive strength			
1	Ceramics / Vitrified Tile	Dimension	IS:13630 Part 1	Field / Lab	Minimum one test for every 1000sqm or part thereof.
		Water Absorption.	IS:13630 Part 2		
		Breaking strength	IS:13630 Part 6		
1	Granite	Moisture	IS:1124	Lab	Minimum one test for every 1000sqm or part thereof.
		Specific Gravity	IS:1122		
1	Steel Tubular	Tensile Test	IS:1608	Lab	One test for every 10 tonne or part
		Bend Test	IS:2329		

Signature of the Contractor

	pipes	Flattering Test	IS:2328		thereof per source and also manufactures test certificates for each consignment should be submitted.
1	Aluminum Sections	Powder coating thickness	CPWD Spec	Field / Lab	One test for every 1000 sqm or part thereof.

Signature of the Contractor