NATIONAL HIGHWAY AND INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

BUILDING INFRASTRUCTURE - BUILDING THE NATION

Ministry of Road Transport & Highways, (Govt. of India)

Request for Proposal
(Through CPP Portal)
For

"Construction of UG OR Living Bunkers (20 Nos.) and UG Tac HQ (4 Nos.) along three different axises from Durbuk in the UT of Ladakh(2nd call)" Through EPC Contract

O/o Executive Director (Projects)
National Highways & Infrastructure Development Corporation Ltd
Regional Office, Ladakh Yartsa House, Near Changspa Farm, Leh -194101, Ladakh

Corporate Head Quarters
National Highways & Infrastructure Development Corporation Ltd
3rd floor, PTI Building, 4-Parliament Street, New Delhi – 110001
CIN No: U45400DL2014GOI269062

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UPLOADED FOR THE INFORMATION OF BIDDER ONLY BUT NOT TO BE UPLOADED BY THE BIDDER

(This will form a part of Contract Agreement with the successful Bidder)

SECTION-VIII

GENERAL CONDITIONS OF CONTRACT AND CONTRACT DATA

DRAFT CONTRACT AGREEMENT

(On notary paper)

This agreement made on _____day of _____ 2023, between the National Highways & Infrastructure Development Corporation Limited, RO-Ladakh (hereinafter called "the Executing Agency" of the one part and _____ (here in after called "the Contractor") of the other part.

AND WHEREAS the Executing Agency invited bids from eligible bidders for the execution of certain works, viz _____

AND WHEREAS pursuant to the bid submitted by the Contractor, vide _____ (here in after referred to as the "BID" or "ÖFFER") for the execution of works, the Executing Agency by his letter of acceptance dated _____ accepted the offer submitted by the Contractor for the execution and completion of such works and remedying of any defects thereon, on terms and conditions in accordance with the documents listed in para 2 below.

AND WHEREAS the Contractor by a deed of undertaking dated _____ has agreed to abide by all the terms of the bid, including but not limited to the amount quoted for the execution of Contract, as stated in the bid, and also to comply with such terms and conditions as may be required from time to time.

AND WHEREAS the contractor has agreed to undertake such works and has furnished a performance security pursuant to clause 28 of the Instructions to bidders (Part- A).

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the conditions of contract hereinafter referred to;

2. The following documents shall be deemed to form and be read and construed as part of this agreement viz.
   a) Contractor's Bid consisting of PART A & PART B of the NIT or RFP including Scope of Work, Tender Drawings, Schedule of Quantities, including Financial Bid viz. BOQ etc.,
   b) Contractor's subsequent letter offering unconditional and voluntary rebate/ acceptance for correction of error in the priced schedule, if any.
   c) Letter of Acceptance (LOA)
   d) Letter of Commencement (LOC)
   e) General Conditions of Contract and Contract Data (GCC), Special Conditions of Contract (SCC)
   f) General/Special/Technical Specification
   g) Finishes Matrix
   h) List of Approved Makes of Materials, Integrity pact and
   i) Any other document listed in the Contract Data.

3. The foregoing documents shall be construed as complementary and mutually explanatory one with another. Should any ambiguity or discrepancy be noted then the order of precedence of these documents shall be subject to the order as listed above and interpreted in the above order of priority.

4. In consideration of the payments to be made by the Executing Agency to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Executing Agency to execute and complete the works and remedy any defects therein in conformity in all respects with the provisions of the contract.

5. The Executing Agency hereby covenants to pay the contractor in consideration of the execution and completion of the works and remedying of defects therein, the contract price or such other sum as may

become payable under the provisions of the contract at the times and in the manner prescribed by the contract.

IN WITNESS WHEREOF the parties here to have caused this agreement to be executed the day and year above written. Signed, sealed and delivered by the said Executing Agency through his Authorized Representative and the said Contractor through his Power of Attorney holder.

Binding Signature of Executing Agency _____

For and on behalf of National Highways & Infrastructure development Corporation Limited, New Delhi

Binding Signature of Contractor _____

For and on behalf of M/s. _____

In the presence of

Witness (Executing Agency)
1. Signature:
Name :
Address:
Witness (Contractor)
1. Signature:
Name :
Address:

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General Conditions of Contract

A. General

1. Definitions

Terms which are defined in the Contract Data are not defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

a. **Bill of Quantities** means the schedule of various items of works including Civil, Electrical, HVAC, MEP etc. with quantities and units which is a part of the financial bid of the bid document through which the bidder is to submit his financial bid based on the mode of bid viz. Percentage/Item Rate/Lumpsum/EPC etc.

b. **Compensation Events** are those defined in Clause 35 hereunder.

c. **Intended or Stipulated Date of Completion** is the date on which the Contractor shall complete all the Works as per the agreement period. The Intended Completion Date is the last date of the stipulated contract period calculated from the date of signing of agreement. The stipulated date of completion may be revised only by the Engineer-in-Charge by issuing an extension of time after the approval from Executing Agency.

d. **Actual Completion Date** is the date of completion of the Works as certified by the Engineer-in-Charge.

e. **Contract** is the complete set of documents consisting of NIT, Instructions to bidder and Appendix to ITB, General Conditions of Contract including Contract Data (GCC) , Special/Additional Conditions of Contract (SCC) , General/Special/ Additional/Technical specifications, BOQ, Schedule of Quantities etc., between the Executing Agency and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed and in its precedence order as mentioned in Clause 2.3.

f. **Contract Data** defines the information relevant to the appropriate clauses of contract.

g. **Contractor** means the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company or the successor of such firm or company and the permitted assignies of such individual firm or company.

h. **Contractor's Bid** is the completed bidding document submitted by the Contractor to the Executing Agency and includes Technical and Financial bids.

i. **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions under the relevent clauses of Contract.

j. **Defect** is any part of the Work(s) not completed in accordance with the Provisions of specificstions, items of work, Instructions of Engineer-in-charge as per relevant clause of Contract during the execution and specified period under Defect Laibility period.

k. **Defects Liability Certificate** is the certificate issued by Engineer-in-Charge, after the Defect Liability Period has ended and upon correction of Defects by the Contractor.

l. **Defects Liability Period** is the period named in contact data and calculated from the Actual Completion Date.

m. **Drawings** include Tender Drawings or Good for construction drawings consisting of architectural, structural, Building services etc. along with technical notes/specifications and other information. Tender Drawings are the drawings enclosed with the RFP conveying indicative scope of the work.

n. **Employer** is a department defined in Contract Data.

o. **Executing Agency** is the party (NHIDCL) as defined in the Contract Data, who employs the Contractor to carry out the Works. The Executing Agency may delegate any or all of its functions to a person or body nominated by him for specified functions.

p. **Engineer-in-Charge** is the person named in the Contract Data (or any other competent person appointed by the Executing Agency and notified to the Contractor, to act in replacement of the Engineer-in-Charge) who is responsible for supervising the execution of the works and administering the Contract.

q. **Equipment** is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

r. **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.

s. **Plant** is any integral part of the Works that shall have a mechanical, electrical, electronic, chemical, or biological function.

t. **Work (s)** shall, unless there be something either in the subject or context repugnant to such construction, being construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent and wether original, altered substituted or additional.The scope of the work is defined under Section X.

u. **Site** means the land, place on, into or where work is to be executed under the contract or any adjacent land or path or street where work is to be executed under the contract including any adjacent land temporarily alloted or used for purpose of carrying the contract.The Site is defined in the contract data.

v. **Specification** shall mean CPWD Specifications Vol. 1 and Vol. 2 -2019 including upto date correction slips issued by CPWD. Specification also includes additional specifications, special specifications for any part or whole of the work specified in the RFP. In the absence of non-availability of specification in CPWD/additional or special specification for any item (s) of work, the manufacturer specification or the local PWD Specification will be adopted and prevailed for the contract.

w. **Sub-Contractor** is a person or firm or company whether incorporated or not undertaking a portion of work as specified in the contract data and shall include the legal personal representative of such individual or the persons composing such firm or company or the successor of such firm or company and the permitted assignies of such individual firm or company.

x. **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Executing agency will provide

instructions clarifying queries about these Conditions of Contract which is binding upon the contractor.

2.2 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority.

i. Contractor's Bid consisting of Scope of Work, Tender Drawings, Schedule of Quantities, including Financial Bid viz. BOQ
ii. Contractor's subsequent letter offering unconditional and voluntary rebate/ acceptance for correction of error in the priced schedule, if any.
iii. Letter of Acceptance
iv. Letter of Commencement
v. General Conditions of Contract and Contract Data(GCC), Special Conditions of Contract (SCC)
vi. General/Special/Technical Specification
vii. Finishes Matrix
viii. List of Approved Makes of Materials, Integrity Pact and
ix. Any other document listed in the Contract Data.

3. Language and Law

3.1 The language of the Contract is English and the law governing the Contract is the law of Union of India.

4. Executing Agency Decisions

4.1 Except where otherwise specifically stated, the Executing Agency will decide contractual matters between the Executing Agency and the Contractor and convey through Engineer-in-charge.

5. Delegation

5.1 The Engineer-in-Charge, duly informing the Executing Agency, may delegate any of his duties and responsibilities to other people except to the Adjudicator, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.

7. Sub-contracting

7.1 The Contractor may subcontract any portion of work, up to a limit specified in Contract Data of each category / component of work, with the prior approval of the Executing Agency in writing. Sub-contracting shall not alter the Contractor's obligations.

7.2 The Contractor shall not be required to obtain any consent from the Executing Agency for:

a. the sub-contracting of any part of the Works for which the Sub-Contractor is named in the Contract;
b. the provision of labour or labour component.
c. the purchase of Materials which are in accordance with the standards specified in the Contract.

7.3 Beyond what has been stated in clauses 7.1 and 7.2, if the Contractor proposes sub-contracting of any part of the work during execution of the Works, because of some unforeseen circumstances to enable him to complete the Works as per terms of the Contract, the Executing Agency will consider the following before according approval:

a) The Contractor shall not sub-contract the Works more than the limit specified in Contract Data.
b) The Contractor shall not sub-contract any part of the Work without prior consent of the Executing Agency. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any of his sub-Contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents and workmen.

7.4 The Engineer-in-Charge should satisfy himself before proposing/recommending to the Executing Agency whether

a) the circumstances warrant such sub-contracting; and
b) the sub-Contractor so proposed for the Work possess the experience, qualifications and equipment necessary for the job proposed to be entrusted to him in proportion to the quantum of Works to be sub-contracted.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other Contractors, public authorities, utilities, and the Executing Agency between the dates given in the Schedule of Other Contractors, as referred to in the Contract Data. The Contractor shall also provide facilities and services for them as described in the Schedule. The Executing Agency may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

8.2 The Contractor should take up the works in convenient reaches as decided by the Engineer-in-Charge to ensure there is least hindrance to the smooth flow of traffic including movement of vehicles and equipment of other Contractors till the completion of the Works.

9. Technical Staff

9.1 The Contractor shall employ the technical personnel named as below. The Engineer in Charge, NHIDCL will approve any proposed replacement of technical personnel only if their relevant qualifications and experience are substantially equal to or better than those of the personnel stated. In the event of personnel stated are not deployed on site by the contractor, a recovery of specified amount mentioned against them will be affected for the period of non-engangement from the payment due to the contractor. If the non-engangement of technical personal is beyond three months, it will be treated as a breach of contract and action will be taken as per relavant clause of the contract viz. Clause 44, 45. The replacement of site Engineer will be approved by Executing Agency.

Sl. No.	Requirement of Technical Representative	Number	Minimum Experience (years)	Designation (Principal Technical/ Technical Representative)	Rate at which recovery shall be made from the contractor in the event of not fulfilling (per month per person)
1	Diploma Engineer (Civil)	1	5	Site Engineer	25,000/-
2	Diploma Engineer (Ele. Or Mech.)	1	5	Site Engineer	25,000/-

9.2 If the Engineer-in-Charge asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the Works in the Contract.

10. Executing Agency's and Contractor's Risks

10.1 The Executing Agency carries the risks which this Contract states are Executing Agency's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Executing Agency's Risks

11.1 The Executing Agency is responsible for the excepted risks which are (a) in so far as they directly affect the execution of the Works in the Executing Agency’s country, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor’s employees), natural calamities and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor’s design.

12. Contractor's Risks

12.1 All risks of loss of or damage to physical property and of personal injury and death, which arise during and in consequence of the performance of the Contract other than the excepted risks, are the responsibility of the Contractor.

13. INSURANCE

Without limiting the Contractor’s obligations and responsibilities stated elsewhere in the Contract, the Contractor shall at his own cost arrange, secure and maintain insurance in the joint names of NHIDCL/ Employer Department and the contractor with any of the Registered General Insurance companies (Public Limited / Private Limited) in such a manner that NHIDCL/ Employer Department and the contractor for the full Execution Period including authorized extension of period plus the defect liability period for the Contract Agreement issued by the Executing Agency. The insurance shall be effected in accordance with terms approved by NHIDCL / Employer Department through the CA clauses and the contractor shall submit the insurance policies to the Engineer-In-Charge within 15 (Fifteen) days of signing of the agreement along with the receipt of premium. The contractor shall timely pay and submit the receipts of payment of premiums for extensions of policies, if any. Contractor shall also at his own cost carry and maintain any and all other insurance(s) which he may be required to take out under any law or regulation from time to time. He shall also carry and maintain any other insurance, which may be required by the

Engineer-in-Charge. The Contractor shall provide to the Engineer-in-charge from time to time he has taken out all the insurance policies referred to above and has paid the necessary premiums for keeping the policies alive till expiry of the Execution Period including authorized extension of period for the Contract Agreement issued by the Executing Agency. The aforesaid insurance policies shall provide that they shall not be cancelled till the Engineer-in-charge has agreed for cancellation.

The contractor can take a single Insurance policy and if required multiple policies to ensure coverage for the following: -

13.1. Contractor's All Risks Insurance (CAR)

The contractor shall insure the work for the full Execution Period including authorized extension of period for the Contract Agreement issued by the Executing Agency and for a sum equivalent to the Contract value or such additional sums as specified and the interests of NHIDCL / Employer Department against ALL RISKS claims, proceedings, loss or damages, costs, charges and expenses from whatsoever cause arising out of or in consequence of the execution and maintenance of the work and for all the materials , Construction Plants , Centering , Shuttering and scaffolding materials and other things brought to site for their full value, for which the contractor is responsible under the contract Agreement. Before commencing the execution of the work, the contractor, shall insure and indemnify and keep NHIDCL/ Employer Department harmless of all claims, against the contractor's liability for any materials or physical damage, loss or injury which may occur to any property, including that of Employer Department or to any person including any employee of NHIDCL/Employer Department, or arising out of the execution of the work or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to above. Such insurance shall be affected for an amount sufficient to cover such risks. The terms shall include a provision whereby, in the event of any claim being brought or made against NHIDCL / Employer Department the insurer shall indemnify NHIDCL /Employer Department against such claims and anycosts, charges and expenses in respect thereof.

The Insurance cover under this proposal shall not be less than the full Contract Amount.

13.2. Workman Compensation & Employers Liability Insurance.(WC& EL)

This insurance shall be affected for all the contractor's employees engaged in the performance of the contract. NHIDCL and the Employer Department shall not be liable in respect of any damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or another person in the employment of the contractor and the contractor shall indemnify and keep indemnified NHIDCL and the Employer Department against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses, whatsoever in respect or in relation thereof. The Insurance cover under this proposal shall not be less than 5 % of the Contract Amount.

The Insurance cover under this proposal shall not be less than 15 % of the Contract Amount.

13.3. Third Party Insurance. (TP)

a) The contractor shall be responsible for making good to the satisfaction of the Engineer-in-Charge any loss or any damage to all structures and properties belonging to NHIDCL/Employer Department or being executed or procured or being procured by NHIDCL/ Employer Department or of the other agencies within

the premises of all work of NHIDCL / Employer Department if such loss or damage is due to fault and or the negligence or wilful acts or omissions of the contractor, his employees, agents, representatives .

b) The contractor shall take sufficient care in moving his plants, equipment and materials from one place to another so that they do not cause any damage to any person or to the property of Employer Department / NHIDCL or any third party including overhead and underground cables and in the event of any damage resulting to the property of the NHIDCL / Employer Department or to a third party during the movement of the aforesaid plant, equipment or materials, the cost of such damages including eventual loss of production, operation or services in any plant or establishment as estimated by the NHIDCL / Employer Department or ascertained or demanded by the third party, shall be borne by the contractor.

c) The Contractor shall ensure that a comprehensive third party Insurance as per standard prescribed norms for incidences of Injury or loss which may occur to any person that of Executing Agency/ Employer department arising out of the execution of the works of permanent or temporary nature for the full Execution Period including authorized extension of period for the Contract Agreement issued by the Executing Agency.

The Insurance cover under this proposal shall not be less than 15 % of the Contract Amount.

13.4. Remedy on the contractor's failure to insure

If the contractor shall fail to effect and keep in force the insurance referred to above or any other insurance which he/they may be required to effect under the terms of the contract then and in any such case Engineer-in-charge may without being bound to, effect and keep in force any such insurance and pay such premium or premiums, as may be necessary for that purpose and from time to time deduct the amount so paid by the Engineer-in-charge from any moneys due or which may become due to the contractor or recover the same as a debt due from the contractor. Apart from this the Engineer-in-charge can impose a penalty on account of such default from the bills payable to the contractor for a sum at his discretion, but not exceeding 0.1% (Zero decimal one percent) of the contract Price.

13.5. INDEMNITIES

The Contractor shall indemnify and hold harmless the NHIDCL/ Employer Department' s Personnel, and their respective agents, against and from all claims, damages, compmpensations, losses and expenses (including legal fees and expenses) in respect of following :

a) The contractor shall indemnify against all claims, damages or compensation under the provisions of Payment or Wages Act-1936, Minimum Wages Act-1948, Employer's Liability Act-1938, The Workman's Compensation Act-1923, Industrial Disputes Act, 1947 and Maternity Benefit Act, 1961, or any modification thereof or any other law relating thereof and rules made there under from time to time

b) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable toany negligence, willful act or breach of the Contract by the NHIDCL, the NHIDCL's personnel, or any of their respective agents, and

c) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that

any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the NHIDCL, the NHIDCL'spersonnel, their respective agents, or anyone directly or indirectly employed by any of them.

14. Queries about the Contract Data

14.1 The Executing Agency will clarify queries on the Contract Data.

15. Contractor to Construct the Works & maintenance during defect liability.

15.1 The Contractor shall construct, install and maintain the Works during defect liability period in accordance with the documents forming part of the contract. No payment for maintenance during defect liability period is payable. If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within the defect liability period after a certificate final or otherwise of its completion shall have been given by the Engineer in-Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit/ retention money or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit / retention money of the contractor shall not be refunded before the expiry of defect liability period after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

16. Milestones, Work Programmes and Extension of contract period

16.1 The time allowed for execution of the Works as specified in the Contract Data or the extended time in accordance with the provisions under relavant clauses of contract shall be the essence of the contract. The execution of the work shall commence from the appointed date/Date of signing of Contract. If the commencement of the work is delayed for any reason including delay in handing over site than the Engineer-in-charge, in consultation with the Executing Agency can intimate the contractor on the change in stipulated date of commencement. If the contractor commits default in commencing the execution of the work as aforesaid, the performance Security shall be forfeited prejudice to any other right or remedy availablein law.

16.2 As soon as possible but within 10 (Ten) working days of award of work and in consideration of:

(a) Schedule of issue of design as specified in the Contract Data the contractor shall submit a Time and Progress Chart for each mile stone. The Engineer-in-Charge may within 7 (seven) working days thereafter required modify, and communicate the programme approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved the Engineer-in-

Charge. The Chart shall be prepared indirect relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Executing Agency and the Contractor within the limitations of time imposed in the contract documents.

(i) In case of non-submission of construction programme by the contractor, the program approved by the Engineer-in-Charge shall be deemed to be final.

(ii) The approval by the Engineer-in-Charge of such programme shall not relieve the contractor of any of the obligations under the contract.

(iii) The contractor shall submit the Time and Progress Chart and progress report using the mutually agreed format or in other format decided by Engineer-in-Charge for the work done during previous month to the Engineer-in-charge on *or before 5th day of each month* failing which the contractor is liable to pay a specifeid amount as determined by the Engineer-in-Charge per week but not exceeding *0.1% of the the Contract price* shall be made on per week or part basis in case of delay in submission of the monthly progress report

16.3 If the work(s) be delayed by:

(i) Force majeure, or

(ii) Abnormally bad weather, or

(iii) Serious loss or damaged by fire, or

(iv) Civil commotion, Local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or

(v) Delay on the part of other contractors or tradesmen engaged by Engineer-in Charge in executing work not forming part of the Contract, or

(vi) Any other cause like above which, in the reasoned opinion of the Engineer-in Charge is beyond the Contractor's control then upon the happening of any such event causing delay, of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge but shall nevertheless use constantly his best endeavours to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

(vii) The contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in sub clause 16.3.

16.4 Milestones for the Work including penalty is given in the Contarct Data.

17. Approvals

17.1 The Contractor shall submit Specifications, Design and Drawings including quantities of each item showing the proposed Works to the Engineer-in-Charge after getting due approvals from the statuatary bodies/vetting from the IIT/NIT Or reputed National or State Research institute within 30 days of signing of Contract Agreement, who shall approve them after proof checking within 7 days, if they comply with specifications and drawings.

17.2 The Contractor shall be responsible for detailed design and drawing of all the civil works and the electro-mechanical equipment/ machinery in the project.

17.3 The Engineer-in-Charge's approval shall not alter the Contractor's responsibility for design of all Works.

17.4 The Contractor shall obtain approval of third parties to the design of all the Works, where required, as directed by the Engineer-in-Charge. The structural design of the buildings shall be made considering Seismic Zone V**.** The contractor shall arrange vetting of structural design and drawings from approved Government Institute like IITs/NITs/Government Engineering College, at his own cost.

17.5 The structural drawings including the foundation type proposed attached with this document is indicative. The contractor has to conduct the Soil Investigation before the start of the work and shall ascertain the bearing capacity of the soil and accordingly the foundation design along with structural design is to be prepared , vetted by the reputed institutes like IIT/NIT and shall obtain the approval from the Engineer-in-charge before start of the work.

17.6 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer-in-Charge before their use.

17.7 The Contractor shall construct the structures as per contract specifications and as per the design approved by the Engineer-in-Charge. In case of any deficiencies, the same will be intimated to the contractor for rectification.

17.8 The Contractor shall submit drawings of all items procured from approved vendors/manufacturer and obtain approval of Engineer-in-Charge before procurement to site.

18. Safety

18.1 The Contractor shall be responsible for the safety of all activities on the Site. The contractor shall follow scrupulously, the worksman compensation act 1923, Contract Labour (Regulation and abolition) Act 1970, Contract Labour (Regulation and abolition) Act 1971, Minimum Wages Act etc. and other Acts & statutory Rules / Provisions as mentioned in the contract agreement.

19. Discoveries

19.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Executing Agency/Employer. The Contractor shall notify the Engineer-in-Charge of such discoveries and carry out the Engineer-in-Charge's instructions for dealing with them.

20. Possession of the Site

20.1 The Executing Agency shall give complete possession of the Site to the Contractor on the date of signing of agreement. In case of any delay due to administrative or any unforeseen reason in handing over of the site either at the start of the work or in phased manner as described in the contact agreement or subsequent correspondence the contractor can apply for extension of time on this account.

21. Access to the Site

21.1 The Contractor shall allow access to the Site and to any place where work in connection with the Contract is being carried out, or is intended to be carried out and to any place where material or plant are being manufactured /fabricated / assembled for the works to the Engineer-in-Charge and any person/persons/agency authorized by:

a. The Executing Agency
b. The Engineer-in-Charge

22. Instructions

22.1 The Contractor shall carry out all instructions of the Engineer-in-Charge, which comply with the applicable laws where the Site is located.

22.2 The Contractor shall permit the Executing Agency to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by Auditors appointed by the Executing Agency if so required by the Executing Agency.

23. Maintenance

23.1 The contractor shall maintain the buildings/structure during the defect liability period of One (1) year which is reckoned from the actual recorded date of completion of the project. No separate payment will be made to the contractor for maintenance during the defect liability period.

24. Dispute and Arbitration

24.1 Dispute Resolution

(i) Any dispute, difference or controversy of whatever nature howsoever arising under or out of or in relation to this Agreement (including its interpretation) between the Parties, and so notified in writing by either Party to the other Party (the "Dispute") shall, in the first instance, be attempted to be resolved amicably in accordance with the conciliation procedure set forth in Clause 24.2.

(ii) The Parties agree to use their best efforts for resolving all Disputes arising under or in respect of this Agreement promptly, equitably and in good faith, and further agree to provide each other with reasonable access during normal business hours to all non- privileged records, information and data pertaining to any Dispute.

24.2 Conciliation

In the event of any Dispute between the Parties, either Party may call upon the Authority's Engineer-in-Charge, or such other person as the Parties may mutually agree upon (the "Conciliator") to mediate and assist the Parties in arriving at an amicable settlement thereof. Failing mediation by the Conciliator or without the intervention of the Conciliator, either Party may require such Dispute to be referred to the Chairman/ Head of the Authority (The Executive Director in charge of the Regional Office, Leh, UT of Ladakh for this agreement) and the Chairman of the Board of Directors of the Contractor for amicable settlement, and upon such reference, the said persons shall meet no later than 7 (seven) business days from the date of reference to discuss and attempt to amicably resolve the Dispute. If such meeting does not take place within the 30 (thirty) business day period or the Dispute is not amicably settled within 30 (thirty) days of the meeting or the Dispute is not resolved as evidenced by the signing of written terms of settlement within 30 (thirty) days of the notice in writing referred to in Clause 24.1. or such longer period

as may be mutually agreed by the Parties, either Party may refer the Dispute to arbitration in accordance with the provisions of Clause 24.3 but before resorting to such arbitration, the parties agree to explore conciliation by the Conciliation Committees of Independent Experts set up by the Authority in accordance with the procedure decided by the panel of such experts and notified by the Authority (The Executive Director in charge of the Regional Office, Leh, UT of Ladakh for this agreement) on its website including its subsequent amendments. In the event of the conciliation proceedings being successful, the parties to the dispute would sign the written settlement agreement and the conciliators would authenticate the same. Such settlement agreement would then be binding on the parties in terms of Section 73 of the Arbitration Act. In case of failure of the conciliation process even at the level of the Conciliation Committee, either party may refer the Dispute to arbitration in accordance with the provisions of Clause 24.3. The conciliation proceedings in terms of meetings, site visits etc. In respect of this agreement at all stages shall take place in Leh in which the Authority's Regional Ofifce is located. The conciliation process shall be initated by either of the party only when the contract is in pendency. There will be no invocation of the conciliation process by either of the party, when the contract become null and void on any ground due to foreclosure/ termination/ rescind.

24.3 Arbitration

(i) Any dispute which remains unresolved between the parties through the mechanisms available/ prescribed in the Agreement, irrespective of any claim value, which has not been agreed upon/ reached settlement by the parties, will be referred to the Arbitral Tribunal as per the Arbitration and Conciliation Act.

(ii) The place of work is located in Leh, in UT of Ladakh. Accordingly any Concilliation/ Arbitration / Legal aspects fall within the jurisdiction of the competent Civil Courts/ Arbitral Tribunal bench established in Leh. All the conciliation/ Arbitral/ legal matters pertaining to this work shall have to be addressed and shall be taken up under the Adjudication of the Hon'ble High Court of Jammu & Kashmir located at Srinagar and its affiliated Arbitral Tribunal, being the competent Court having the Jurisdiction in Ladakh, in the absence of any such legal establishment / bench either in Leh.

(iii) The Arbitral Tribunal shall make a reasoned award (the "Award"). Any Award made in any arbitration held pursuant to this Clause 24 shall be final and binding on the Parties as from the date it is made, and the Contractor and the Authority agree and undertake to carry out such Award without delay.

(iv) The Contractor and the Authority agree that an Award may be enforced against the Contractor and/or the Authority, as the case may be, and their respective assets wherever situated.

(v) This Agreement and the rights and obligations of the Parties shall remain in full force and effect, pending the Award in any arbitration proceedings hereunder. Further, the parties unconditionally acknowledge and agree that notwithstanding any dispute between them, each Party shall proceed with the performance of its respective obligations, pending resolution of Dispute in accordance with this Article.

(vi) In the event the Party against whom the Award has been granted challenges the Award for any reason in a court of law, it shall make an interim payment to the other Party for an amount equal to 75% (seventy five per cent) of the Award, pending final settlement of the Dispute. The aforesaid amount shall be paid forthwith upon furnishing an irrevocable Bank Guarantee for a

sum equal to 120 % (one hundred and twenty per cent) of the aforesaid amount. Upon final settlement of the Dispute, the aforesaid interim payment shall be adjusted and any balance amount due to be paid or returned, as the case may be, shall be paid or returned with interest calculated at the rate of 10% (ten per cent) per annum from the date of interim payment to the date of final settlement of such balance.

24.4 Adjudication by Regulatory Authority, Tribunal or Commission

In the event of constitution of a statutory regulatory authority, tribunal or commission, as the case may be, with powers to adjudicate upon disputes between the Contractor and the Authority, all Disputes arising after such constitution shall, instead of reference to arbitration under Clause 24.3, be adjudicated upon by such regulatory authority, tribunal or commission in accordance with the Applicable Law and all references to Dispute Resolution Procedure shall be construed accordingly. For the avoidance of doubt, the Parties hereto agree that the adjudication hereunder shall not be final and binding until an appeal against such adjudication has been decided by an appellate tribunal or court of competent jurisdiction, as the case may be, or no such appeal has been preferred within the time specified in the Applicable Law.

B. Time Control

25. Determination/ Rescind of contract

Subject to other provision contained in this clause, the Executing Agency may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, not following safety norms, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine / rescind the contract in any of the following cases:

(i) if the contractor having been given by the Executing Agency a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

(ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence and continues to do so after a notice in writing of seven days from the Executing Agency.

(iii) If the contractor fails to complete to work or section of work with individuals date completion on or before the stipulated or justified extended date, on or before such date of completion; and the Executing Agency without any prejudice to any other right or remedy under provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence contract and in the opinion of Executing Agency the contractor will be unable to complete the same or does not complete the same within the periods specified.

(iv) If the contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Executing Agency.

(v) If the contractor shall offer or give or agree to give to any person in Government service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or

for bearing to do or for having done or for borne to do any act in relation to the obtaining or execution of this or any other contract for Government.

(vi) If the contractor shall enter into a contract with Government in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such Commission and the terms of payment thereof have been previously disclosed in writing to the Executing Agency.

(vii) If the contractor had secured the contract with Government as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.

(viii) If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

(ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitled the court to make a winding up order.

(x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.

(xii) If the contractor assigns (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (unless provisioned in the relavant clause of contract specifically and as mentioned in contract data) (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Executing Agency.

(xiii) If the contractor fails to fulfill his repsonsibility to provide the requited Technical personal as mentioned under clause 9 for a period of more than three months consecutively or keeping his technical personal erratically in the project which in the discretion of the Engineer-in-charge is detrimental for the quality and progress of the work.

When the contractor has made himself liable for action under any of the cases aforesaid, the Executing Agency on behalf of the employer shall have powers:

(a) To determine / rescind the contracts aforesaid so far as performance of the work by the Contractor is concerned (Of which determined notice in writing to the Contractor under the hand of the Executing Agency shall be conclusion evidence). Upon such determination, the Earnest Money Deposit, Security Deposit already recovered, Security deposit payable and performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Government.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work. In the event of above courses being adopted by the Executing Agency, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Executing Agency has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

Clause 25 A

In case, the work cannot be started due to reason not within the control of the contractor within $1/8^{th}$ of the stipulated time for completion of work or one month whichever is higher, either party may close the contract by giving notice to the other party stating the reasons. In such eventuality, the Performance Security of the contractor shall be refunded within 30 days.

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

26. Extension of time and delay in execution of contract

26.1 In case the work is hindered, by the Department or for any reason / event, for which the Department is responsible, the excuting agency, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law; provided further that for concurrent delays under this sub clause and sub clause 16.2 to the extent the delay is covered under sub clause 16.2 the contractor shall be entitled to only extension of time and no damages.

26.2 Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed forms i.e. application by the contractor for seeking rescheduling of milestones or Form of application by the contractor for seeking extension of time (Annexure- 1) respectively to the authority as indicated in Contract Data. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is desired.

With every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than 10% of the stipulated period of completion of contract, the contractor shall produce a revised programme without causing any delay in execution of the work. A recovery as specified in Clause 16.2 in case of delay in submission of the revised programme.

26.3 In any such case the authority as indicated in Contract Data may give a fair and reasonable extension of time for completion of work or reschedule the mile stones. Executing agency shall finalize/ reschedule a particular mile stone before taking an action against subsequent mile stone. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in Contract Data in writing, within 21 days of the date of receipt of such request from the Contractor in prescribed form. In event of non application by the contractor for extension of time Executing agency after affording opportunity to the contractor may give, supported with a programme (as specified under 16 above), a fair and reasonable extension within a reasonable period of occurance of the event.

26.4 In case the work is delayed by any reasons, in the opinion of the Executing Agency, by the contractor for reasons beyond the events mentioned in clause 11.1 or clause 16.3 or clause 20.1 and beyond the justified extended date; without prejudice to right to take action under Clause 24 & clause 38, the Executing Agency may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

26.5 The Executing Agency may instruct the Contractor to delay the start or progress of any activity within the Works programme approved by the Engineer-in-charge.

27. Management Meetings

27.1 Either the Engineer-in-Charge or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for the remaining Works and to deal with matters raised in accordance with the early warning procedure.

27.2 The Engineer-in-Charge shall record the business of management meetings and provide copies of the record to those attending the meeting. The responsibility of the parties for actions to be taken shall be decided by the Engineer-in-Charge either at the management meeting or after the management meeting and stated in writing to all those who attended the meeting.

C. Quality Control

28. Identifying Defects

28.1 If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within *twenty four months* after a certificate final or otherwise of its completion shall have been given by the Engineer in- Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit/ Retention money or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit/

Retention Money of the contractor shall not be refunded before the expiry of twenty-four months since the issurance of certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

28.2 Correction of Defects noticed during the Defect Liability Period.

a) The Engineer-in-Charge shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins from the next day of Actual Recorded Date of Completion of Project and as defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

b) Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the reasonable time specified by the Engineer-in-Charge's notice as per good industry practice. If any defect including shrinkage cracks, other faults appears in the work within defect liability period, the Engineer-in-Charge shall give Notice to the Contractor of such defects before end of defect liability period and shall extend the defect liability period as long as defects remain to be corrected.

28.3 Uncorrected Defects/ Incomplete Works

a) If the Contractor has not corrected the defect(s) to the satisfaction of the Engineer-in-Charge within the time specified in the Engineer-in-Charge's notice/indent, the Engineer-in-Charge will assess the cost of having the Defect corrected and get the defects rectified through some other agency at the risk and cost of the Contractor and the Contractor will pay 1.2 times of this amount.

b) If the Contractor has not completed the work to the satisfaction of the Engineer-in-Charge, within the time specified in the Engineer-in-Charge's notice/indent, in no case exceeding one month, the Engineer-in-Charge will assess the cost of having the work completed and get the work completed through some other agency and the Contractor will pay this amount in addition to the damages specified as per clause 38.

c) Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Liability Period shall be remedied/ rectified by the Contractor at their cost if the loss or damage arises from the Contractor's acts or omissions.

29. Tests

29.1 The contractor shall be solely responsible for:

a. Carrying out the mandatory tests prescribed in the CPWD Specifications 2019 (volume-I and volume II) and technical specifications forming part of contract.

b. For the correctness of the test results, whether preformed in his laboratory or elsewhere.

c. All charges related to cost of samples, transportation to third party lab and testing charges are deemed to be included in the Contract Price of Contractor and hence will not be reimbursed by Executing Agency.

d. The Executing Agency may engage third party for testing of executed items. The payment for the same would be made by the Executing Agency.

e. Maintain and update all site stock and material test registers in approved format.

29.2 The Engineer in charge shall be the only authorised person to communicate defects to the contractor for which rectification to be carried out. The entire work is to be carried out to the entire satisfaction of the Engineer incharge. No other person either from Employer or from Executing

agency shall be authorised to communicate any defects/tests to be carried out by contractor. The decision of Engineer in charge regarding satisfaction of the quality and acceptance of work shall be final and binding upon all. If the Engineer-in-Charge instructs the Contractor to carry out a test not specified in the Specification to check whether any work (executed by the contractor) has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no defect, the cost of such tests shall be borne by the Authority otherwise by the Contractor.

D. Cost Control

30. Bill of Items

30.1 *The contract shall be on EPC mode. The Lumsum amount quoted by the contractor in the Bill of Items in the form of financial bid shall be the contract price for the construction, installation and commissioning of all components of the whole project including maintenance for one year Defect Liability Period and for comprehensive annual maintenance of the E&M system/equipments during the four-year period beyond the one-year Defect Liability Period, to be done by the Contractor.*

30.2 *Contract Price shall be quoted excluding GST. GST at the existing rate & applicable laws will be paid to the contractor along with the each bill; however, the contractor has to submit the proof of GST payment to Government before next bill. In case, of non-submission of GST proof, the same will be recovered in the next bill.*

30.3 *The payment to contractor shall be made in accordance with the percentage Payment Schedule mentioned below:*

a) The Contract Price (exclusive of GST) for this EPC Agreement is Rs. …….. /-.

b) The Contractor shall enclose the computerized measurements (three copies) of all items of work executed (stage-wise and bunker/Tac structure) till the date of submission of running bills for verification by Engineer-in-Charge and record.

c) Payment for incomplete works shall not be made generally. In the event of unforeseen circumstances or due to force majere conditions or due to reasons attributable to the Employer/Executing Agency, if any. Activity remains in complete, payment for same shall be made on pro-rata basis as determined by the Engineer in Charge. Incomplete work means stage of Activity has remained incompete or its sub activity have remain incomplete as per the payment schedule given below.

d) Proportions of the Contract Price for different stages of Construction of the stage of acitivity shall be as specified below:

(For intermittent payments thorugh Running Account Bills, payment will be released based on work done and on achievement of physical progress of work in any component / Sub component of the stage wise payment.)

Payment Schedule

Sr. No.	Stage of Activity	% of Item Contract Value	Break-up of item
1.	Planning, Detailed Design, Soil investigation & Approval from Statutory Bodies, third party vetting (If any) and approval of the same by the Engineer-In-Charge. (The time limit for design of Architectural, the statuary bodies/IIT or premium institutes- 30 days from appointed date shall be completed including vetting of the same from IITs/NITs or premium institutes within 30 days from appointed date)	3%	
1.1	On submission of vetted structural drawings from IITs/NITs - 30 days from appointed date and approval of Engineer-in-Charge.		2%
1.2	On approval of water distribution system, Electrical after vetting from IITs/NITs within 30 days from appointed date.		1%
2. (a)	On completion of 1st slab of Bunker @ 1.25 % of a bunker for 20 Bunkers	31%	25%
2.(b)	On completion of 1st slab of UG Tac Hqr @ 1.25% of a UG Tac Hqr for 4 UG Tac Hqr		6%
3.(a)	On Completion of masonary works, fixing of doors and windows frames etc of Bunker @ 0.75% of a bunker for 20 bunkers.	18%	15%
3.(b)	On Completion of masonary works, fixing of doors and windows frames etc of UG Tac Hqr @ 0.75% of a UG Tac Hqr for 4 UG Tac Hqr		3%
4(a).	Completion of all Finishing Works viz plasterings, paintings, steel work, waterproofing, floorings, drain, Over Head Protection (OHP), Fire Extinguiser, etc of Bunker @ 1.25 % of a Bunker for 20 bunkers	29%	25%
5	Completion of all Finishing Works viz plasterings, paintings, steel work, waterproofing, floorings, drain, Over Head Protection (OHP), Fire Extinguiser, etc. for each UG TAC @ 1 % for 4 bunkers.		4%
6	On completion of Solar light, DG sets, electical items, Fire and Smoke alarm systems, etc @ 0.5% for 20 bunkers and 4 UG Tac Hq	12%	12%
7	On completion of septic tank and soak pit for all buildings and finishes complete and other misc items of workswhich has not been covered under S.No.1 to 6 above.	4%	4%

8	On declaration of Completion of the project by Competent Authority, submission of all statutory post-construction clearances and as-built drawings, handing over of building and successful closing of agreement.	3%	3%
	TOTAL	100%	

Note 1: The bidder may with the approval of the Executing Agency and the Employer can adopt the conceptual/ indicative drawings uploaded with the NIT for execution. Not withstanding the approval from the Executing Agency, the final responsibility of the design of project rests with the successful bidder. The successful bidder will have to ensure the soundness of the Architectural and soundness of the structural drawings by vetting through premium institutes such as IITs/NITs.

31. Variations in Quantites, Pricing

31.1 A) The Engineer-in-Charge shall have power (i) to make alteration in, additions to or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work in accordance with the procedure as stated under clause-31.2.

B) The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered be extended, if requested by the contractor, as follows:

(i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus

(ii) 25% of the time calculated in (i) above or such further additional time in terms of working months as may be considered reasonable by the Engineer-in-Charge.

31.2 Change of Scope (Extra or substituted Items and deviation):

a) In case of any change of scope in approved scope of work given by the Employer Department / Executing Agency and forming part of the Contract (or) if there are any deviation either in positive side or negative side in the Number of structures, indicative SoQ items, New technologies/ alternative technologies, specifications of the SoQ items, in such case the contractor may within fifteen days of receipt of order from Engineer in Charge has to submit his claim for such change in scope. The Engineer-in-charge in consultation with the Executing Agency will arrive at the amount payable / deductable to the EPC contractor after calculating the same in Pro-rata basis in the lines of similar structures/ components of the work in the scope of the work of Contract Agreement (or) based on Standard scheduled of Rates of J&K 2020 or CPWD DSR 2021 or as per prevailing market rate in that order of hierarchy (First J&K SOR has to be referred. If such items not available in J&K SOR, DSR CPWD may be referred. If not available in both, market rates may be referred), as the case may be and the contractor shall be paid / deducted in accordance with such assessment which is binding on the contractor. In such cases the the Contract amount will be adjusted after adding or discounting to the applicable extent either on positive side or on negative side.

The prescribed time limit for finalizing rates / amount for such change in scope or Extra Item(s), Substitute Item(s) and Deviated Quantities of contract items under the change of scope is 45 days after submission of proposal by the contractor.

b) In case there is change/ modification in drawings given by the contractor after the approval by the Engineer -in- Charge due to functional or site requirements the contractor shall carry out the changes including extra items, substitute items, deviations as per direction of Engineer in Charge for which nothing extra shall be payable to the contractor on account of same. However the contractor's proposal in any case shall not be inferior to the original proposal in terms of the area constructed, quality, specification and inclusive of its cost variation and if such

cost variation is more than 1% of the CA amount, the same is to be approved by the Executing Agency based on the recommendations of the Engineer-in-charge either on positive or negative side.

c) The contractor shall ensure that the total amount corresponding to change of scope in terms of Variations, Extra or Substrituted items shall not exceed 10 % of the contract price at any point of time. The Engineer-in-charge in consultation with Executing agency / Employer will accord sanction for the change in scope in terms of variation, Extra and substituted item under change of scope and any delay in getting approval from the Employer for additional amounts is to be bear by the contractor and no additional amount due to price escalation or interest on amount due to him is not admissible. Since the extant project is of strategic importance and situated in harsh locations, the power to further relax the limit of 10% of contract price shall rest with Employer. Moreover, withdrawal of any item of work from the scope of the contractor shall also be limited to 10% of the contract price.Withdrawal shall mean any work which are omitted from the scope of the contractor which will cause the contract price to be reduced by its 10%, despite there may be variation or addition in the contract price. For Example if contract price is Rs.100. Positive variation on account of addition of work is Rs 10. Withdrawal of work is Rs 21.Then contract price =100+10-21= Rs 89 which is more than 10% limit i.e. Rs 90. Such amount of withdrawal shall not be valid. The contract price shall be reduced to the extent of 90% of the value of work withdrawn i.e if the value of work to be withdrawn is RS 10, then contract price shall be reduced by Rs 9 and not Rs-10.

32. Cash Flow Forecasts

32.1 When the Programme is updated, the Contractor shall provide the Engineer-in-Charge with an updated cash flow forecast.

33. Payment Certificates

a) No payment shall be made for work through intermediate payments (running bills), until the value of work done is less than or equal to 1/8th of the contract price for all works having contract price value upto and equal to 5 Cr.

b) For the work having contract price above 5 Cr. Intermediate payments (running bills) will be paid to the contractor as per the stage wise payment mentioned in the payment schedule.

c) The interim or running account bills shall be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the Department in triplicate on or before the date of every month fixed for the same by the Engineer-in-Charge.

d) The contractor shall without fail submit his bill for intermediate payment to the engineer-in-charge on a fixed date of every month to be determined by the engineer-in-charge to ensure financial progress in consistent with physical progress. In the event of the failure of the contractor to submit the bills, no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor.

e) The Engineer-in-charge shall arrange to have the bill verified by taking or causing to be taken, where necessary, the requisite measurements of the work. Payment on account of amount admissible shall be made by the Engineer-in-Charge certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge.

f) The amount admissible shall be paid by 10th working day after the day of presentation of the bill by the Contractor to the Engineer-in-Charge or his Authorized Engineer together with the account of the material issued by the department, or dismantled materials, if any.

g) The Executing Agency shall arrange for the payment to the contractor from the available fund received from the employer department to the extent available, or made efforts to arrange payment by taking up the case with the employer department to arrange sufficient funds. The payment to the contractor is to be perceived as a back to back arrangement since the executing agency does not taking up the work from its own sources of funds.

h) All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications.

i) Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

34. Payments

34.1 Payments shall be adjusted for deductions for mobilization payments, 5% security deposit (retention money), other recoveries in terms of the Contract and taxes at source, as applicable under the law. The Executing Agency shall pay the Contractor the amounts Engineer-in-Charge had certified within 14 days of the date of each certificate.

34.2 The contractor shall submit to the Engineer-in-Charge bill in three copies and the Executing Agency shall make the payment certified by the Engineer-in-Charge.

34.3 The Contractor shall submit to the Engineer-in-Charge a bill prepared in accordance with the approved quantities and as per the Payment Schedule as mentioned in contract document for the work executed.

34.4 The minimum value of work of all the executed items for each building/Services should be 5% of the Total Cost (Civil, Architectural, Electrical, HVAC, PHE & Fire Fighting) of the work for the purpose of claiming of running bill unless specifically mentioned in the payment schedule. In case if the corresponding weighatge is not fully achieved due to unforeseen circumstances/ events beyond the control of the contractor at the time of submission of bill, the Engineer-in-charge can recommend a Pro-rata payment at his discretion with detailed justification and duly certified by him while forwarding the intermediate Running Account Bills.)

34.5 GST charges at applicable rates on the actual value of the work done in every running bill shall be reimbursed subject to furnishing documentary evidence of having paid to Government the GST charges reimbursement paid in the previous bill. The documentary evidence shall be specific to the work.

35. Compensation Events

35.1 The following shall be Compensation Events unless they are caused by the Contractor:

a) The Engineer-in-Charge orders a delay or does not issue/approve drawings, specifications or instructions required for execution of works in reasonable time.

b) The Engineer-in-Charge gives an instruction for dealing with an unforeseen condition, caused by the Executing Agency, or additional work required for safety or other reasons.

c) Other contractors, public authorities, utilities or the Executing Agency does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

35.2 If a Compensation Event would prevent the Works being completed before the Intended Completion Date, the Intended Completion Date shall be extended. The Engineer-in-Charge shall decide whether and by how much the Intended Completion Date shall be extended after the approval of the Executing Agency.

35.3 The contractor shall not be entitled to compensation to the extent that the Executing Agency's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer-in-Charge/Executing Agency.

36. Currencies for payments

All payments will be made in Indian Rupees.

37. Performance Security

37.1 Within 30 (Thirty) days after the issue of LoA or before signing of contract agreement, the successful Bidder shall deliver to the Executing Agency a Performance Security i.e. Five (5%) percent of the Contract Price plus the GST applicable for this work, valid for the period of 60 days beyond the stipulated date of completion. The Bid security amount of the successful bidder will be refunded after 30 days from the receipt of the conformation from the bank and on the request of the successful bidder.

37.2 The bidder shall also have to pay the additional performance security if any in accordance with the provisions mentioned in clause 24.3 of ITB in Part A of the bid document along with the performance security for the same period. The extent rules applicable in the executing agency department are binding on the successful bidder.

37.3 The performance security shall be in the form of an Electronic Bank Guarantee (e-BG) in the name of the Executing Agency, from a Bank as per the details specified below as per Annexure-H. It is madatory that the Electronic Bank Gurantee (e-BG) taken shall be encashable at the Leh Branch of the issuing Bank. Electronic Bank Gurantee (e-BG) shall be accepted from Public Sector Banks or Scheduled Private Sector Banks having Net worth of Rs. 1,000/- Crores or more as per latest annual report of the bank. Authority reserves the right to add or remove any of name's bank on which e-BG shall be accepted based on advisory from the Government/RBI. The e-BGs issued by 'Foreign Banks' and 'Banks not mentioned in the list below' shall not be accepted.The Electronic Bank Gurantee (e-BG) can be initially taken for a period of not less than one year and shall has to be extended from time to time for the total period as mentioned in 28.1 above, incase if the bank norms do not give the Bank Guarantee for the specified period at one stretch.

37.4 The Performance security and additional performance security shall be initially valid up to the 60 days beyond stipulated date completion. In case the time for completion of works gets extended, the contractor shall get the validity of performance Guarantee extend to cover such extended time for completion of work.

37.5 After recording of the completion certificate for the work by the competent authority, the Performance security and additnal performance security if any shall be returned to the contractor, without interestwith in 60 days. However, in case of contract involving CAMC / maintenance of building and services/any other works after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Rentetion Money / Security Deposit. The same shall be returned year wise proportionately during the specified period as mentioned in the Payment schedule.

37.6 The Engineer-in -Charge shall not make a claim under the performance guarantee except for amounts to which the president of India is entitled under the contract (not withstanding and/or without prejudice to any other provision in the contract agreement) in the event of:

(a) Failure by the contract to extend the validity of the Performance Guarantee as describe herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.

(b) Failure by the contractor to pay Executing Agency any amount due, either as agreed by the contractor or determined under any of the clauses/conditions of the agreement, with 30 days of the Service of notice to this effect by Engineer-in Charge.

37.7 In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the President of India.

37.8 On substantial Completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a provisional completion certificate shall be recorded by the Engineer-in-Charge. The provisional certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with provisions of the contract.

37.9 This completion certificate shall be recorded by the concerned Engineer-in-charge with the approval of Executing Agency, if required. After recording of the completion Certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest as statyed above.

37.10 It is to be noted that incase the branch of the Bank issuing Electronic Bank Gurantee (e-BG) is other than their branch located at Leh in UT of Ladakh, due to their administrative or business reasons, then they shall convey through their official mail to the Executing Agency and to their branch located ast Leh in UT of Ladakh, that they will undertake that the Perforamnce Electronic Bank Gurantee (e-BG) given by them will be made encahsable at their Leh branch (or) they will direct their Leh branch to accept the Performance Electronic Bank Gurantee (e-BG) in original and will fecilitate for encashment of the same in case of receipt of the communication from NHIDCL for invocation / encashment of the same and shall not reject on any grounds. Further, if the issuing bank does not have their branch in Leh, UT of Ladakh, in such case, the issuing bank shall undertake that on receipt of official communication from Executing Agency through e-mail or by post for invocation of encashment, they will do needful for encashment of the Electronic Bank Gurantee (e-BG) given by them, and will not insist for producing the orginal Electronic Bank Gurantee (e-BG) to them, and also on physical presence/ visit of their branch by officials of Executign Agecny.

List of the Banks

List of Public Sector Banks		
Bank of Baroda	Indian Bank	State Bank of India
Bank of India	Indian Overseas Bank	Union Bank of India
Bank of Maharashtra	Punjab National Bank	Central Bank of India
Canara Bank	Punjab & Sind Bank	UCO Bank

List of Scheduled Private Sector Banks		
Axis Bank Ltd.	ICICI Bank Ltd.	Indusind Bank Ltd.
HDFC Bank Ltd.	IDFC First Bank Ltd.	Jammu & Kashmir Bank Ltd.
IDBI Bank Ltd.		

37. (A) Security Deposit / Retention Money

The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit the Executing Agency at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running and final bill till the sum deducted will amount to 5% of the tendered value of the work, which is treated as the Security deposit/ Retention Money.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or recovered thorugh this security deposit/ Retention money, of the whole or a sufficient part of this security deposit and from the interest arising there from, or from any sums which may be due to or may become due to the contractor by NHIDCL on any account whatsoever. In the event of his Security Deposit / Retention money being reduced by reason of any such deductions as aforesaid, the contractor shall within 10 days make good the same. In the event of failure to do so the Engineer-in-charge will make good the same by deducting the corresponding amount in the subsequent bills payable to the contractors if any, at a higher rates than the prescribed limit of 5% which shall be considered as having deemed acceptance by the contractor.

The security deposit as deducted above can be released against E- bank Guarantee of a Schedule Bank, on its accumulations to a minimum of Rs.5.00 lakhs subject to condition that amount of such e-BG, except last one, shallnot be less than 5.00 lakhs.

The Security deposit / retention Money will be released to the contarctor as per provisions under clause 37.5 mentioned above i.e within 60 days of completion of defect Liability period.

38. Liquidated Damages

If the contractor fails to maintain the required progress in terms of clause 26 or to complete the work and clear the site on or before the contract or justified extended date of completion as per clause 26 as well as any extension granted under clauses 31, he shall, without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as compensation the amount calculated at the rates stipulated below as the authority specified in Contract Data may decide on the amount of accepted Tendered Value of the work for every

completed day/month (as determined) that the progress remains below that specified in Clause 26 orthat the work remains incomplete.

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10 % (ten percent) of the accepted Tendered Value of work or of the accepted Tendered Value of the Sectional part of work as mentioned in Contract Data for which a separate period of completion is originally given.

In case no compensation has been decided by the authority in Contract Data during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Engineer in Charge decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under clause 12, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under clause 26, the contractor shall be liable to pay compensation for such delay.
Provided that compensation during the progress of work before the justified extended date of completion for delay under this clause shall be for non-achievement of sectional completion or part handing over of work on stipulated/justified extended date for such part work or if delay affects any other works/services. This is without prejudice to right of action by the Engineer in Charge under clause 25 for delay in performance and claim of compensation under that clause.
In case action under clause 38 has not been finalized and the work has been determined under clause 25, the right of action under this clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the Executing Agency , after due consideration of justified extension. The compensation for delay, if not decided before the determination of contract, shall be decided after of determination of contract.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Government. In case, the contractor does not achieve a particular milestone mentioned in Contract Data, or the re-scheduled milestone(s) in terms of Clause 16, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied as above. With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

39. Advance Payment

39.1 **Mobilization Advance:**

a) The Mobilization Advance will be paid to the contractor purely at the discretion of the Execution Agency and does not confer a right to the contractor for claiming the same.

b) The Executing Agency shall make an interest-bearing advance payment (the “Advance Payment") @ “Bank Rate + 3%", not exceeding 10 % (ten percent) of the Contract Price, exclusively for mobilization expenses, if requested by the contractor in writing within one month of the order to commence the work. “Bank Rate" means the standard rate at which Reserve Bank of India is prepared to buy or re-discount bills of exchange or other commercial paper eligible for purchase under the Reserve Bank of India Act 1934.

c) The Advance Payment for mobilization expenses shall be made in two installments each equal to 5% (five percent) of the Contract Price. The second 5% (five percent) mobilization advance would be released after submission of utilization certificate by the Contractor for the first 5% (five per cent) advance already released earlier.

d) The Contractor may apply to the Executing Agency for the first installment of the Advance Payment at any time after issuance of order to commence the work, along with an irrevocable and unconditional Electronic Bank Gurantee (e-BG) from a Bank for an amount equivalent to 110% (one hundred and ten percent) of such installment, substantially in the form provided at Annexure-I, to remain effective till the complete and full repayment thereof. The recovery of mobilization advance shall be effective on achieving financial progress of 10% and fully recovered on achieving 80% financial progress on pro-rata basis along with interest. It is to to be noted that the guidelines issued under clause 28 of the Part A of NIT in respect of the Electronic Bank Gurantee (e-BG) for performance security are applicable for the mobilization advance also in toto.

e) It is to be noted that incase the branch of the Bank issuing Electronic Bank Gurantee (e-BG) is other than their branch located at Leh in UT of Ladakh, due to their administrative or business reasons , then they shall convey through their official mail to the Executing Agency and to their branch located ast Leh in UT of Ladakh, that they will undertake that the Perforamnce Electronic Bank Gurantee (e-BG) given by them will be made encahsable at their Leh branch (or) they will direct their Leh branch to accept the Performance Electronic Bank Gurantee (e-BG) in original and will fecilitate for encashment of the same in case of receipt of the communication from NHIDCL for invocation / encashment of the same and shall not reject on any grounds. Further, if the issuing bank does not have their branch in Leh, UT of Ladakh, in such case, the issuing bank shall undertake that on receipt of official communication from Executing Agency through e-mail or by post for invocation of encashment, they will do needful for encashment of the Electronic Bank Gurantee (e-BG) given by them, and will not insist for producing the orginal Electronic Bank Gurantee (e-BG) to them, and also on physical presence/ visit of their branch by officials of Executign Agecny.

39.2 Secured Advanceagainst Materials: the contractor on signing an indenture in the form attached as Annexure-II, shall be entitled to be paid during the progress of the execution of the work uoto 75% of the assessed value of any materials which are in the opinion of the Executing Agency non-perishabled, non-fragile an non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advane

been incoprporated in the works. The materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/deducted from the next payment made under any of the clause or clauses of the contract.

Such secured advance shall also be payable on other item of perishable nature, fragile and combustible with the approval of the Authority provided the contractor provided a comprehensive insurance cover for the full cost of such materials. The decision of the Executing Agency shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high risks materials such as oridinary glass, sand, petrol, diesel etc. And the Executing Agency shall always remain indemnified from losses or consequesnces thereto.

E. Finishing the Contract

40. Completion

40.1 When the whole of the works has been completed as per the provision of the Contract, the Contractor shall request the Engineer-in-Charge to issue a certificate of Completion of the Project. The Engineer-in-Charge shall, within 14 days of the date of receipt of such request, either issue to the Contractor, with a copy to the Executing Agency, a completion certificate, recording the date on which, the project was completed in accordance with the contract, or give instructions in writing to the contractor specifying all the works which, in the Engineer-in-Charge's opinion, is required to be done by the Contractor before the issue of such completion certificate.

41. Taking Over

41.1 The Executing Agency shall take over the Site and the Works within fifteen days of the Engineer-in-Charge's issuing a certificate of Completion.

42. Final Account

The Contractor shall supply to the Engineer-in-Charge with a detailed account of the total amount that the Contractor considers payable under the Contract within three months of physical completion of the work or within one month of date of the final certificate of completion furnished by the Engineer-in-charge, whichever is earlier but before the end of the Defects Liability Period.

No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period of three months the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized representative.

The Engineer-in-Charge will certify any final payment that is due to the Contractor within 60 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer-in-Charge shall issue within 60 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the

Engineer-in-Charge shall decide on the amount payable to the Contractor and issue a payment certificate within 60 days of receiving the Contractor's revised account.

For carrying out the comprehensive annual maintenance of the contract, the Executive Agency will draw a supplementary agreement with the contractor with a time period of Five(5) years wef recorded date of completion of work. The Contractor shall render CAMC services free of cost during the one year period of defect liability period. There-after, the Contractor shall be paid for CAMC services for next four years at the quoted rates as mentioned in payment schedule .The payment for the CAMC service shall be made every quarter in equal instalments of the rate quoted for the particular year.

43. "As built" Drawings

The Contractor is required to submit 'As Built Drawing' for the work executed before release of final bill payment. If the Contractor does not supply the "As Built' Drawings and/or manuals by the stipulated date or they do not receive the Engineer-in-Charge's approval, the Engineer-in-Charge shall withhold the amount equal to Rs. 5 lakhs from payments due to the Contractor.

44. Termination/Foreclosure

44.1 The Executing Agency may terminate the Contract if the Contractor causes a fundamental breach of the Contract.

44.2 Fundamental breaches of Contract include, but shall not be limited to, the following:

a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Programme and the stoppage has not been authorized by the Engineer-in-Charge;

b) the Contractor is declared as bankrupt or goes into liquidation other than for approved reconstitution or amalgamation;

c) the Engineer-in-Charge/Executing Agency gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer-in-Charge;

d) the Contractor does not maintain a Security, which is required;

e) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in clause 45;

f) the Contractor fails to provide insurance cover as required under clause 13;

g) if the Contractor, in the judgement of the Executing Agency, has engaged in the corrupt or fraudulent practice in competing for or in executing the Contract. For the purpose of this paragraph, " Corrupt practice" means (i) the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bidding Process (For avoidance of doubt, offering of employment to, or employing, or engaging in any manner whatsoever, directly or indirectly, any official of the Authority who is or has been associated in any manner, directly or indirectly, with Bidding Process, at any time prior to the expiry of one year from the date such official resigns or retires from or otherwise ceases to be in the service of the Authority, shall be deemed to constitute influencing the actions of a person connected with the Bidding Process);

h) "Fraudulent practice" means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bidding Process; if the Contractor

has not completed at least thirty percent of the value of Work required to be completed after half of the completion period has elapsed;

i) if the Contractor fails to set up a field laboratory with the prescribed equipment, within the period specified; and

44.3 Without prejudice to any other right or remedies which the Executing Agency may have under this contract, upon occurrence of a Contractor's fundamental breach of contract, the Executing Agency shall be entitled to terminate this contract by issuing a Termination Notice to the Contractor ; provided that before issuing the Termination Notice, the Executing Agency shall by a Notice inform the Contractor of its intention to issue such Termination Notice and grant 15 days to the Contractor to make a representation, and may after the expiry of such 15 days, whether or not it is in receipt of such representation, issue the Termination Notice.

44.4 Notwithstanding the above, the Executing Agency may terminate the Contract for convenience.

44.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible but in no case later than 7 days.

44.6 **F**oreclosure - NHIDCL may foreclose the contract before the expiry of the scheduled contract period due to administrative decision by givingone month Notice.

44.7 Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the Executing Agency on behalf of the Employer shall have the option of terminating the contract without compensation to the contractor.

45. Payment upon Termination / Foreclosure due to Breach of Contract by Contractor:

45.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer-in-Charge

a) Upon such determination, Security Deposit / Retention money already recovered, Security deposit / retention money payable and performance Security under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Executing Agency.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work. In the event of above courses being adopted by the Engineer-in-Charge/ Executing Agency, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

c) The Engineer-in-charge shall issue a certificate for the value of the work done less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Executing Agency exceeds

any payment due to the Contractor, the difference shall be a debt payable to the Executing Agency and Executing Agency may recover the same from Performance security.

45.2 Foreclosure with Mutual Consent:

In case, the work cannot be started due to reason not within the control of the contractor within 1/8th Of the stipulated time for completion of work or one month whichever is higher, either part y may close the contract by giving notice to the other party stating the reasons.in such eventuality, the Performance Guarantee of the contractor shall be refunded within 30 days. Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

46. Property

All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Executing Agency for use for completing balance work if the Contract is terminated because of the Contractor's fundamental breach of contract.

47. Release from Performance

If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of the Executing Agency or the Contractor, the Engineer-in-Charge shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.

48. Price Escalation

DELETED

F. Other Conditions of Contract

49. Labour

49.1 The Contractor shall, make arrangements of his own cost and expenses for the engagement of all staff and labour, local or others; for their payment, housing, feeding and transport; and for compliance with various labour laws/ regulations.

49.2 The Contractor shall, as asked by the Engineer-in-Charge, deliver to the Engineer-in-Charge a return in detail, in such form and at such intervals as the Engineer-in-Charge may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer-in-Charge may require.

50. Compliance with Labour Regulations

50.1 During the currency of the Contract, the Contractor and his sub Contractors shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be notified already or that may be notified under any labour law in future either by the State or the Central Government or the local authority.

Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Executing Agency indemnified in case any action is taken against the Executing Agency by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Executing Agency is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer-in-Charge/Executing Agency shall have the right to deduct any money due to the Contractor including from his performance security/ retention money. The Executing Agency/Engineer-in-Charge shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Executing Agency. The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Executing Agency at any point of time.

50.2 **SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK.**

a) **Workmen Compensation Act 1923**: - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

b) **Payment of Gratuity Act 1972**: - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed the prescribed minimum years (say, five years) of service or more or on death the rate of prescribed minimum days' (say, 15 days) wages for every completed year of service. The Act is applicable to all establishments employing the prescribed minimum number (say, 10) or more employees.

c) **Employees P.F. and Miscellaneous Provision Act 1952**: The Act Provides for monthly contributions by the Executing Agency plus workers at the rate prescribed (say, 10% or 8.33%). The benefits payable under the Act are:

   i. Pension or family pension on retirement or death as the case may be.
   ii. Deposit linked insurance on the death in harness of the worker.
   iii. Payment of P.F. accumulation on retirement/death etc.

d) **Maternity Benefit Act 1961**: - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

e) **Contract Labour (Regulation & Abolition) Act 1970**: - The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Executing Agency by Law. The principal Executing Agency is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Executing Agency if they employ prescribed minimum (say 20) or more contract labour.

f) Minimum Wages Act 1948: - The contractor shall have to comply with the provisions/ guidelines under this act failing which the Executing Agency will take needful action to ensure the implementation of this act at the risk and cost of the contractor. This act gives guidelines / directions to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment in the field of constructions of buildings, roads, runways are scheduled employment.

g) **Payment of Wages Act 1936:** - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

h) **Equal Remuneration Act 1979**: - The Act provides for payment of equal wages for work of equal nature to male and female workers and for not making discrimination against female employees in the matters of transfers, training and promotions etc.

i) **Payment of Bonus Act 1965**: - The Act is applicable to all establishments employing prescribed minimum (say, 20) or more workmen. The Act provides for payments of annual bonus within the prescribed range of percentage of wages to employees drawing up to the prescribed amount of wages, calculated in the prescribed manner. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. States may have different number of employment size.

j) **Industrial Disputes Act 1947**: - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

k) **Industrial Employment (Standing Orders) Act 1946**: - It is applicable to all establishments employing prescribed minimum (say, 100, or 50). The Act provides for laying down rules governing the conditions of employment by the Executing Agency on matters provided in the Act and get these certified by the designated Authority.

l) **Trade Unions Act 1926**: - The Act lays down the procedure for registration of trade unions of workmen and Executing Agencys. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

m) **Child Labour (Prohibition & Regulation) Act 1986**: - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulations of employment of children in all other occupations and processes. Employment of child labour is prohibited in building and construction industry.

n) **Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act 1979**: - The Act is applicable to an establishment which employs prescribed minimum (say, five) or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as Housing, Medical-Aid, Travelling expenses from home up to the establishment and back etc.

o) **The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996** and **the Cess Act of 1996**: - All the establishments who carry on any building or other construction work and employs the prescribed minimum (say, 10) or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Executing Agency of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodations for workers near the work place etc. The Executing Agency to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

p) **Factories Act 1948:** - The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned

leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing the prescribed minimum (say, 10) persons or more with aid of power or another prescribed minimum (say, 20) or more persons without the aid of power engaged in manufacturing process.

q) **Employer's Liability Act -1938:** The Employers' Liability Act was legislated with the objective of ruling out certain defences arising out of injuries sustained by workmen. This law was enacted to safeguard the interests and for the protection of workmen who bring suit for damages for injuries endured by them. The Contractor shall take all needful measures for fulfilment of the provisions under this Act.

r) **The Arbitration and Conciliation Act 1996 (Amended up to 2019):**An Act to consolidate and amend the law relating to domestic arbitration, international commercial arbitration and enforcement of foreign arbitral awards as also to define the law relating to conciliation and for matters connected therewith or incidental thereto.

51. Drawings and Photographs of the Works

51.1 The contractor shall do photography/videography of the site firstly before the start of the work, secondly mid-way in the execution of different stages of work and lastly after the completion of the work. No separate payment will be made to the contractor for this.

51.2 The Contractor shall not disclose details of Drawings furnished to him and works on which he is engaged without the prior approval of the Engineer-in-Charge in writing. No photograph of the works or any part thereof or plant employed thereon, shall be taken or permitted to be taken by the Contractor or by any of his employees or any employees of his sub-Contractors without the prior approval of the Executing Agency in writing. No photographs/ Videography shall be published or otherwise circulated without the approval of the Executing Agency in writing.

CONTRACT DATA

Clause Reference	Conditions of Contract
1 (o)	**Executing Agency** Designation: ExecutiveDirector (P) Address: NHIDCL, RO-Ladakh, Leh, Ladakh, PIN-194101 Email: nhidcl.leh@gmail.com
1 (n)	**Employer** Indian Army HQ-3 INF Division, Kharu, Distt. Leh, Ladakh
1 (p)	**Engineer-in-Charge** Designation: General Manager (P) / Deputy General Manager (P) NHIDCL PMU, Infra , Leh Address: NHIDCL, PMU-Infra, Leh, Ladakh, PIN-194101 Email: nhidcl.infraleh@gmail.com
1 (u)	**Site** is located at along three different axes from Durbuk in the distt of Leh**,** the Union Territory of Ladakh
1(w), 7.1, 7.3(a)	The limit of subcontracting is 49%**.**

<table>
<tr><td>8.1</td><td>Schedule of Other Contractor - NIL</td></tr>
<tr><td>13.1</td><td>Amount for insurance is:
13.1- CAR - Rupees equivalent to Contract price.
13.2- WC&EL - Rupees equivalent to 5% of Contract price.
13.3 - Third Party Insurance (TP) cost Rupees equivalent to 5% of contract price taken for a duration of Contract execution period+ Authorized extension period+Defect Liability period.</td></tr>
<tr><td>16.1 & 28.2</td><td>The Time period for Completion of the Work is 18 months [including non working six (6) months] from stipulated date of commencement plus One year Defect Liability period (DLP).</td></tr>
<tr><td>16.2</td><td>The time limit for design of Architectural, Structural,HVAC, Electrical, MEP shall be completed including vetting of the same from the statuary bodies/IIT or premium institutes- 30 days from appointed date</td></tr>
<tr><td>23.1 & 28.2</td><td>The Defects Liability Period for all items under the work is One (1) year from the actual recorded date of completion of the project.</td></tr>
<tr><td>24</td><td>Authority: Executing Agency</td></tr>
<tr><td>26.2</td><td>Authority to give extension of Time: Executing Agency</td></tr>
<tr><td>37.1</td><td>Within 30 (Thirty) days after the issue of LoA or before signing of contract agreement, the successful Bidder shall deliver to the Executing Agency a Performance Security i.e. Five (5%) percent of the Contract Price plus GST applicable for this work valid for the period of 60 days beyond the stipulated date of completion.
The bidder shall also has to pay the additional performance security if any Bid in accordance with clause 24.3 of ITB of Part A of the bid document along with the performance security for the same period. The extent rules applicable in the executing agency department are binding on the successful bidder.</td></tr>
<tr><td>38</td><td><table>
<tr><td>a.</td><td>Amount of liquidated damages for delay in completion of works</td><td>0.50 percent of the Initial Contract price, rounded off to the nearest thousand, per week</td></tr>
<tr><td>b.</td><td>Maximum limit of liquidated damages for delay in completion of work.</td><td>10 per cent of the Initial Contract Price rounded off to the nearest thousand</td></tr>
<tr><td>c.</td><td>Authority for determining Liquidated Damages</td><td>Executing Agency</td></tr>
</table></td></tr>
<tr><td>45.1</td><td>The percentage to apply to the value of work not completed representing the Executing Agency's additional cost for completing the work shall be 20%.</td></tr>
<tr><td>48</td><td>Minimum Time Period for applicablility of Price Escalation:Above Six months (Not Applicable if equal to or less than six months)</td></tr>
<tr><td>48.3</td><td>The component X for Material: 75% of Contract Price
The component Y for Labour: 25% of Contract Price</td></tr>
</table>

Clause 16: Milestones for the Work including penalty.

Mile Stone No.	Financial Progress	Months from Appointed date	Amount to be withheld in case of non-achievement of Milestone
1	Completion of all are part of 10%	One (1) Months	0.5% of Contract price
2	Completion of all are part of 35%	Ten (10) Months	1% of Contract price
3	Completion of all civil and allied works 70%	Fifteen (15) Months	1% of Contract price
4	Handing over of site and completion of full work 100%.	Seventeen(17) Months	1% of Contract price

Annexure- I

FORM OF APPLICATION BY THE CONTRACTOR FOR SEEKING EXTENSION OF TIME

1. Name of contractor
2. Name of work as given in the agreement
3. Agreement no.
4. Estimated amount put tender
5. Date of commencement of work as per agreement
6. Period allowed for completion of work as per agreement
7. Date of completion stipulated in agreement
8. Period for which extension of time has been given previously:

	GM(P), PMU's letter no. and date	**Extension granted**	
		Months	**Days**
(a) 1st extension …….			
(b) 2nd extension ……..			
(c) 3rd extension ……..			
(d) 4th extension ……..			
(e) Total extension previously given…….			

9. Reasons for which extension have been previously given (copies of the previous applications should be attached)
10. Period for which extension if applied for
11. Hindrances on account of which extension is applied for with dates on which hindrances occurred and the period for which these are likely to last.
    (a) Serial no.
    (b) Nature of hindrance
    (c) Date of occurrence
    (d) Period for which it is likely to last
    (e) Period for which extension required for this particular hindrance
    (f) Overlapping period if any, with reference to item. (g) Net extension applied for
    (h) Remarks, if any.
    Total period on account of hindrances mentioned above…… Months …… Days
12. Extension of time required for extra work
13. Details of extra work and the amount involved:
    (a) Total value of extra work
    (b) Proportionate period of extension of time based on estimated amount put to tender on account of extra work.
14. Total extension of time required for 11 & 12

Submitted to the Sub Divisional Officer ……

Signature of contractor
Dated

Annexure-II

FORM OF APPLICATION OF THE CONTRACTOR FOR SEEKING RESCHEDULING OF THE MILESTONES

1. Name of contractor
2. Name of work as given in the agreement
3. Agreement no.
4. Estimated amount put tender
5. Date of commencement of work as per agreement
6. Period allowed for completion of work as per agreement
7. Date of completion stipulated in agreement
8. Rescheduling of milestones done previously

Milestone No. Already Rescheduled	**GM(P), PMU's letter no. and date**	**Rescheduling Of Milestones Done**	
		Original Date	Rescheduled Date
(a) 1st extension ……			
(b) 2nd extension ……..			
……..			

Rescheduling of milestone applied for

Milestone No. For Which Rescheduling is Applied	Original/ Rescheduled Date	Details And Period of Hindrances	Comments of Executive Engineer	Proposed Rescheduled Date of
(a) 1st extension ……				
(b) 2nd extension ……..				
……..				

Submitted to the Sub Divisional Officer

Signature of Contractor
Dated

SAMPLE GUARANTEE BOND

This agreement made this_____ day of_____ 2022 between M/s_____ (here-inafter called the Guarantor of the one part) and the **Executive Director (P), National Highways and Infrastructure Development Corporation Limited, Regional Office, Ladakh** here-inafter called the Government of the other part).

Where as this agreement is supplementary to the contract (here-in after called the Contract) dated _____made between the Guarantor of the one part and Government of the other part, where-bythe Contractor, inter alia, undertook to render the buildings and structures in the said Contract recited, completely_____----*[Write item of guarantee like termite-proof/waterandleak-proof.]*

And whereas the Guarantor agree to give a guarantee to the effect that the said structure will remain termite-proof/water-proof for **ten (10) years** to be reckoned from the date after the defect liability period prescribed in the contractexpires.

During this period of guarantee the Guarantor shall make good all defects and for that matter, shall replace at his risk and cost …… *[write the component : such as such wooden members as may be damaged by termites,]* and in case of any other defect being found he shall render the building ……. *[write the component : such termite-proof]* at his cost to the satisfaction of the Engineer-in-charge, and shall commence the works of such rectification within seven days from date of issuing notice from the Engineer-in-charge calling upon him to rectify the defects, failing which the work shallbegotdonebythe NHIDCL bysomeotherContractorattheGuarantor'scostandrisk, andinthe later case the decision of the Engineer-in-charge as to the cost recoverable form the Guarantor shall be final and binding.

That if the Guarantor fails to execute the …… *[Write the component : such anti-termitetreatment] waterproofing* or commits breaches here-under then the Guarantor will indemnify NHIDCL/Employer and his successors against all loss, damage, cost, expense or otherwise which maybe incurred by him by reason of any default on the part of the Guarantor in performance and observance of this supplemental agreement. As to the amount of loss and/or damage and/or cost incurred by the NHIDCL/Employer, the decision of the Engineer-in-charge will be final and binding on the parties.

In witness where-of these presents have been executed by the Obligor_____ and by_____ for and on behalf of the NHIDCL on the day, month and year first above written.

Signed, sealed and delivered by **OBLIGOR** in the presence of–

1

2

Signed for and onbehalf of **NHIDCL** by……..……in the presence of.

1

2

Form for Guarantee for Mobilization Advance Payment

To

_____[Name of the Authority]

_____[Address of the Authority]

WHEREAS:

(A) [name and address of contractor](here-in after called the "Contractor")has executed an agreement (herein after called the "Agreement")with the [name and address of the authority],(herein after called the "Authority") for the construction of the.....(name of work)....., subject to and in accordance with the provisions of the Agreement

(B) In accordance with Clause 46 of the Agreement, the Authority shall make to the Contractor an interest bearing **@Bank Rate + 3%** advance payment (herein after called**"Advance Payment"**) equal to 10%(ten per cent) of the Contract Price; and that the Advance Payment shall be made in two installments subject to the Contractor furnishing an irrecovable and unconditional guarantee by a scheduled bank for an amount equivalent to **110% (one hundred and ten percent)** of such installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement. The amount of {first/second} installment of the Advance Payment is Rs. _____cr.(Rupees_____crore)and the amount of this Guarantee is Rs. _____cr.(Rupees_____crore)(the ”Guarantee Amount”).

(The Guarantee Amount shall be equivalent to 110% of the applicable installment)

(C) We, through our branch located at Leh in UT of Ladakh (the "Bank™)have agreed to furnish this bank guarantee (herein after called the "Guarantee") for the Guarantee Amount.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably,guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid instalment of the Advance Payment under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, andwithout any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim ,without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.

A letter from the Authority, under the hand of an officer not below the rank of [General Manager in the National Highways Authority of India], that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the installment of the Advance Payment under and inaccordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in defaultshall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor; or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

2. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

3. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.

4. The Authority shall have the liberty, without affecting in any manner the liability of the Bankunder this Guarantee, to vary at any time, the terms and conditions of the Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or for bear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of theliberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any othermatter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

5. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Advance Payment.

6. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities here-under.

7. The Guarantee shall cease to be in force and effect on "*Unless a demand or claim under this Guarantee is made in writing on or before the aforesaid date, the Bank shall be discharged from its liabilities here-under.

8. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

9. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forth-with, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

10. This Guarantee shall come into force with Immediate effect and shall remain inforce and effect up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

11. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision,I CC Publication No. 758, except that the supporting statement under Article 15(a) is here by excluded.

12. This guarantee shall also be operatable at our local branch located in Leh, UT of Ladakh, from whom, confirmation regarding the issue of this guarantee or extension / renewal or encashment thereof shall be made available on demand. In the contingency of this guarantee being **invoked** and payment there under **claimed,** the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

13. We, being a branch of the same bank other than our Leh Branch from which this Performance Bank Gurantee is issued, undertake that we will send thorugh our official mail to the Executing Agency and to our Leh Branch that the Perforamnce Bank Gurantee given by us will be made encahsable at our Leh branch. Further we undertake that we will direct our Leh branch to accept the Performance Bank guarantee in original and will fecilitate for encashment of the same in case of receipt of the communication from NHIDCL for invocation / encashment of the same and shall not reject on any grounds. Further, in case of absence of our branch at Leh, UT of Ladakh, we undertake that, being the issuing bank of this BG and on receipt of official communication from Executing Agency through e-mail or by post for invocation of encashment, we will do needful for encashment of the Bank guarantee given by us based on such written communication, and will not insist for producing the orginal BG, and also on physical presence/ visit by officials of Executign Agecny at our issuing branch.

14. The guarantor/bank hereby confirms that it is on the SFMS (Structural Finance Messaging System) platform &shall invariably send an advice of this Bank Guarantee to the designated bank of NHIDCL, details of which is as under:

Sr. No.	**Particulars**	**Details**
1	Name of Beneficiary	NHIDCL UT Ladakh Project Account
2	Beneficiary Bank Account No.	362305000136
3	Beneficiary Bank Branch Name and Address	ICICI Bank Leh Ladakh
4	Beneficiary Bank Branch IFSC	ICIC0003623

Signed and **sealed** this.....day of _____20___ at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code **Number)**

(Address)

NOTES:

The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

The address, telephone number and other details of the head office of the Bank as well as of issuing branch should be mentioned on the covering letter of issuing branch.

INDENTURE FOR SECURED ADVANCES

THIS INDENTURE made the.....day of..... 20 ..... BETWEEN .....(herein after called the Contractor which expression shall where the context so admits or Implies be deemed to include his executors administrators and assigns) of the one part and the NHIDCL (hereinafter called the Authority which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated.....(hereinafter called the said agreement) the Contractor has agreed AND WHEREAS the Contractor has applied to the Authority that he may be allowed advances on the security of materials absolutely belonging to him and brought by him on the site of the works the subject of the said agreement for use in the construction of such of the works as he has under taken to execute as per contract price (inclusive of the cost of materials and labour and other charges) AND WHEREAS the Authority has agreed to advance to the Contract or the sum of Rupees.....on the security of materials the quantities and other particulars of which are detailed in the Running Account Bill for the said works signed by the Contractor on.....and the Authority has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees .....on or before the execution of these presents paid to the Contractor by the Authority (the receipt where-of the Contractor do there by acknowledge) That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter by made as aforesaid(hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the General Manager(P), NHIDCL, PMU(Infra) , Leh under NHIDCL, RO-Ladakh, Leh (here-in after called the General Manager) and in the term of the said agreement.

and of such furtherAdvances (if any) as may be made to him as aforesaid the Contractor do there by covenant and agree with the Authority and declare as follows:-

1. That the said sum of Rupees.....so advanced by the Authority to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.

2. That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the Authority as security are absolutely the Contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and Contractor indemnifies the Authority against all claims to any materials in respect of which an advance has been made to him as aforesaid.

3. That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter by made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the General Manager(P) of PSU Leh (here-in after called the General Manager) and in the term of the said agreement.

4. That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that unutilized in construction as aforesaid the said materials shall remain at the site of the said works in the

Contractor's custody and on his own responsibility and shall at all times be open to inspection by the General Manager or any officer authorised by him. In the event of the said materials or any part there of being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the General Manager.

5. That the said materials shall not on any account be removed from the site of the said works except with the written permission of the General Manager or an officer authorised by him on that behalf.

6. That the advances shall be repayable in full when or before the Contractor receives payment form the Authority of the price payable t him for the said works under the terms and provisions ofthe said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Authority will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used In the construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

7. That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Authority shall immediately on the happening of such default be repayable by the Contractor to the Authority together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs charges, damages and expenses incurred by the Authority in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the Authority to repay and pay the same respectively to him accordingly.

8. That the Contractor hereby charges all the said materials with the repayment to the Authority of the said sum of Rupees.....and any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents PROVIDEDALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if any whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith the Authority may at any time thereafter adopt all or any of the following course as he may deem best:-

   a. Sieze and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay same to the Authority on demand.
   b. Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the Authority under these presents and pay over the surplus (ifany) to the Contractor.

c. Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

9. That except in the event of such default on the part of the Contractor as aforesaid interest on the said advances hall not be payable.

10. That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the Executive Director(P), NHIDCL,RO-Ladakh, Leh whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

In witness whereof the said .....and .....by the order and under the direction of the Authority have here unto set their respective hands the day and year first above written.

Signed, sealed and delivered by.....

The said contractor in the presence of Witness

Signature.....

Name.....

Address.....

Signed by.....

By the order and direction of the Authority in the presence of

Witness

Signature.....

Name.....

*****

FORM OF SUPPLEMENTARY AGREEMENT

This Agreement made this day the _____ between _____hereinafter called the First Party which expression shall include his heirs, executors and administrators/their successors and assigns and the **Executive Director(P), National Highways and Infrastructure Development Corporation Limited, Regional Office, Ladakh**, hereinafter called the Secondary Party, which expression shall include his successors and assigns, shown as under:

1. That this Agreement shall be called as Supplementary Agreement to the Agreement No. _____ relating to the Name of work **"Construction of Modern Mechanized Slaughter House at Bombgarh, Leh in the UT of Ladakh ( )"** entered into by the parties to this Agreement.

2. That WHEREAS the First Party has substantially completed the execution of the work described in and covered by the Agreement No. _____ except the items mentioned in the Schedule annexed to this Agreement and whereas the items of the work mentioned in the Schedule annexed to this agreement cannot now be executed on account of the need to comply to observations of District Fire Officer for according Fire NOC and some other related work; and whereas both the parties are desirous that the items mentioned in the Schedule annexed to this Agreement should be executed by the First Party as specified in the original Agreement No. _____, it is hereby further agreed as under:

   (a) That First Party shall and will execute the work covered by the items mentioned in the Schedule annexed to this Agreement at the rates and as per the terms and conditions of the original Agreement No._____ whatsoever called upon to do so by the Engineer-in-Charge, within a period of **one year** from the date hereof.

   (b) That the First Party shall have absolutely no claim of whatsoever nature against the Second Party for doing the work mentioned in the Schedule annexed to this Agreement as required under clause (a) above, except that which he would be entitled to under the original Agreement No._____**.**

   (c) That the First Party shall have to execute all the items which the Engineer-in-Charge consider necessary.

   (d) That the First Party shall start with the work of the remaining items mentioned in the Schedule annexed to this Agreement from the next day of recorded date of completion of the work of original Agreement no._____ on the receipt of a letter to the effect from the Engineer-in-Charge or from any date fixed in the said letter and shall complete the said work within the time fixed by the Engineer-in-Charge or as extended by him from time to time.

   (e) That on the due execution and completion of this Agreement by the parties, the bill of the First Party in relation to the work already done by him under the Original Agreement No._____ shall be provisionally finalized by the Second Party and payment on account, if any amount due, shall be made to the First Party provided that the Second Party shall have a right to retain such amount as is considered reasonable by him as a security for the execution of the work mentioned in the Schedule annexed to this Agreement and the Second Party shall have right to deal with the said amount of security as he thinks proper under the terms and conditions of the Original Agreement. Further, on the due execution and original completion of this Agreement, the First Party shall be entitled to claim back his security deposit relating to the work in question, subject to the right of the Second Party to retain such amount as he thinks reasonable as mentioned above soon after the maintenance period of **Five (5) years** as mentioned in clause of the Original Agreement, is over.

(f) That quarterly payment are made by the Second Party to the First Party for the services rendered during the period of Supplementary Agreement at the rates quoted by the First Party in the Original Agreement No._____.

3. Except as modified by this Agreement the said Agreement No._____ shall remain in full force and effect.

IN WITNESS WHEREOF THE ABOVE MENTIONED PARTIES HAVE PUT THEIR SIGNATURE ON THIS DAY THE……

SECTION-IX

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF CONTRACT

(CIVIL, PHE, INTERNAL ROADS, INTERIOR WORK, LANDSCAPING)

1.0 GENERAL :

1.1. Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Schedule of Quantities, specifications of work, tender drawings , finishes matrix and any other documents forming part of this contract wherever the context so requires. The order of precedence of the above documents shall be interpreted as per General Conditions of Contract.

1.2. Notwithstanding the sub-division of the document into these separate sections and volumes, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.

1.3. The materials, design and workmanship shall satisfy the relevant Indian Standards (Latest), the job specifications contained herein and other national / international codes (Latest) referred to. Where the job specifications, stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any Standards/Specifications/Codes of practices for detailed specifications covering any part of the work covered in this tender, Contractor shall ensure that the work is executed as per the best and sound engineering practices and/or as per the instructions/directions of Engineer- in-Charge. The decision of EIC as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on the Contractor and no claim whatsoever shall be entertained on this account.

1.4. The Contractor shall execute the whole and every part of the Works in the most professional and workman-like manner and both as regards materials and in other respects in strict accordance with specifications and latest Indian and international codes.

1.5. The Contractor shall also conform exactly, fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the Engineer-in-Charge and lodged in his office and to which the Contractor shall be entitled to have an access for the purpose of inspection at such office or on the site of the work during office hours. The Contractor will submit four sets of duly signed and stamped working drawings in hard copies for approval.

1.6. Excavated good earth declared surplus or otherwise shall be disposed of at designated locations as per the directions of the Engineer – in – charge,which shall be different from the disposal site for clay soil.

1.7. For soil required for re-filling, if sufficient space is not available for stacking at site of excavation, the Contractor shall make his own arrangements for transporting and stacking the earth elsewhere and then bring it back for re-filling.Nothing extra shall be paid on this account for to and fro carriage.

1.8. Disposal of surplus excavated earth including mud, liquid mud, dismantled RCC, dismantled brick work etc. shall be made only in the dumping yard approved by local authority. It will be the responsibility of the contractor to get the permission for dumping yard from local authority as required. If any royalty/fees are payabletolocal authority, such royalty/fees shall also be borne by the contractor. Disposal shall be carried out strictly as per the regulations of local authority. However, the above materials shall not be removed out of owner's premises without prior written authorization of EIC.

1.9. The Contractor shall put in place a Vehicle Wash area to ensure that the vehicles exiting the construction work site are free from sediment to avoid dirtying the public roads.

The Contractor shall carefully protect and preserve all bench marks, site details, pegs and other things used in the setting out of the building for Construction. All preliminary works such as establishment of a set of bench marks, permanent DGPS, Total Station/theodolite stations, centre line pillars, etc including required materials, tools, plants, equipment, labour, etc. for performing such functions necessary and ancillary there to for the commencement and during the progress of the work and till physical completion of the work shall be carried out by the Contractor at his own cost. It shall be Contractor's responsibility to shift the existing benchmark to his work site to set out the necessary control points and alignment of the various works.

1.10. The Contractor shall also provide DGPS instrument with other required precision Survey Instruments as per site requirement and/or as directed by EIC. The work of setting out shall be deemed to be a part of general works preparatory to the execution of the work and no separate payment shall be made for the same.

1.11. The work will be carried out in accordance with the architectural drawings and structural drawings approved by the Engineer-in-Charge. The structural and architectural drawings shall have to be properly correlated before executing the work.

1.12. In case of any difference noticed between Architectural and Structural drawings, the Contractor shall intimate the differences/discrepancies to EIC well in advance prior to scheduled start of the relevant item of works and shall obtain final decision in writing of the Engineer-in-Charge before executing the particular portion of the work. The delay caused on account of non-timely action by the Contractor in resolution of the differences whatsoever shall not be considered as compensation event for extension of time unless otherwise accepted by EIC.

1.13. In case of any discrepancy in the description of the item of the schedule of quantities submitted along with bid by the contractor and approved architectural drawings relating to the relevant item, the provision of former shall prevail unless given otherwise in writing by the Engineer-in-Charge,

1.14. Drawings giving complete information for the fabrication of the component parts including the location, type, size, length and details of connections shall be prepared well in advance by the contractor before the actual fabrication and got approved from the Engineer-in-Charge. Delay in submission of the drawings by the contractor causing consequent delay in approval by the Engineer in charge shall not absolve the contractor of his responsibilities.

1.15. Wherever the BoQ item stipulates design, the Contractor shall have to supply designs and drawings which shall have to be vetted by any IIT/NIT/Govt Engineering College or any other Institute of repute as approved by Engineer – in – charge, and all costs towards the same, including charges for vetting shall be deemed to have been included in the quoted rates.

1.16. Plumbing drawings are schematic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the structural, architectural and other services drawings. Detailed drawings shall be prepared by the Contractor and got approved by EICwell in advance prior to start of the relevant item of work.

1.17. Architectural drawings shall take precedence over plumbing or other services drawings in respect of overall dimensions unless and otherwise directed by EIC.

1.18. All temporary works, ancillary works, enabling works, including dewatering of surface and subsoil water, preparation and maintenance of temporary drains at the work site, preparation and maintenance of approaches to working areas, wherever required, for execution of the work, shall be the responsibility of the Contractor and all costs towards the same shall be deemed to have been included in the quoted prices

1.19. The Contractor shall, at his own expense and without extra charges, make provision for all pumping, dewatering, dredging or bailing out water, if necessary, irrespective of the source of water. The water so pumped out shall be discharged as per local byelaws and as approved by the Engineer-in-charge. The Contractor shall also take all necessary precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property within/outside the plot. Excavated area for the basement/ foundation trenches shall be kept free from water while all the works below Ground level are in progress. Nothing extra shall be paid on this account in terms of time and cost.

1.20. The Contractor shall at his own expense and without extra charges, take all precautions such as shoring for all depths or any other arrangement as approved by Engineer-in-Charge for ensuring that there shall be no sliding / collapsing of the excavated earth and nothing extra shall be payable on account of shoring/other arrangements.

1.21. Earth work in excavation and filling for, building works shall be governed under provisions of CPWD Specifications and Delhi Analysis of Rates (DAR), plan of internal road works and any other works not related to building works shall be governed by MORTH Specifications and MORTH Standard Data Book for Analysis of Rates.

1.22. Further contractor shall take all necessary precautions to protect and safe guard the foundation of the adjacent building / Structure / Overhead/Underground utilities. Nothing extra shall be payable on this account.

1.23. The rate for every item of work to be done under this contract shall be for all levels, leads and heights and nothing extra shall be paid on this account.

1.24. For items covered by J&K SoR/CPWD Specifications, reference may be made to the relevant CPWD Specifications. Where it is felt that the CPWD Specifications concerned does not reflect the full scope of work under any item, reference may be given to Indian Standards or any other relevant Specifications.

1.25. Should work be suspended by reason of rain, strike, lockouts or any other cause, Contractor shall take all precautionary measures for the protection of works and at his own cost and shall make good any damage arising from any of these causes to satisfaction of EIC

1.26. Work shall normally be done in a single shift/day. However if the work is required to be executed in more than one shift in a day for meeting the time lines, the Contractor with prior approval of the Engineer – in – charge, shall have to make necessary arrangements for the same and all costs towards the same shall be deemed to have been included in the quoted rates

1.27. Defect liability period shall start from the date of taking over of entire project after its completion in all respects as per the scope of the contract by the Engineer – in – charge. Taking over of the entire project shall be reckoned as actual date of completion of the project.

1.28. Labour Camp:

Contractor shall make his own arrangements to set up labour camps. The facilities like dwelling units, water supply, lighting arrangement, drainage and sanitation as stipulated in the contract shall be arranged by the Contractor and all costs towards the same shall be deemed to have been included in the quoted rates.

The Contractor shall put in place an arrangement for controlled entry and exit of labourers / workers / technicians with Gate Passes or Identification Badges with Colour photographs individually authorized by the Contractor and all costs towards the same shall be deemed to have been included in the quoted prices.

The Contractor shall take all measures prescribed by Govt. of India in respect of Covid-19. It is the responsibility of the contractor to adhere to all Covid-19 guidelines issued from time to time and strictly implementing them at work site and in labour camp.

1.29. Precision Works

Machine foundations, equipment installations are precision works. Contractor shall ensure utmost precision in location of holding down bolts, slots, pockets and the like with (+/-) 1 mm tolerance.

1.30. Maintenance of Register of Tests –

All the registers of tests carried out at Construction Site or in outside laboratories shall be maintained by the contractor which shall be issued to the contractor by Engineer-in-charge. Contractor shall be responsible for safe custody of all the test registers.

1.31. Method Statement

The contractor shall submit a 'Methods statement' for the approval of the EIC soon after the award of work to him. The 'Methods statement' is a statement by which the construction procedures for important activities of construction are stated, checked, and approved. The 'Methods statement', should have a description of the item with elaborate procedures in steps to implement the same, the specifications of the materials involved, their testing and acceptance criteria, equipment to be used, precautions to be taken, mode of measurement, etc.

1.32. Floors & Levels :

a) Floor 1 shall be the lowest floor above the average ground level of the main building to be constructed at site. The Floor above Floor 1 shall benumbered in sequence as Floor 2, Floor 3 andso on. The number shall increaseupwards.

b) Floor Level - Top level of structural slab shall be the floor level.

c) Plinth Level - Floor 1 level shall be the plinth level.

2.0 WORK PROGRAMME:

2.1 The Contractor shall, within 10 days after the date of award of the work, submit his detailed work programme preferably in Microsoft Project, detailed Project quality plan for works executable at site and also at manufacturer's place, safety plan, for the approval of the Engineer in - charge, which shall clearly set out his proposed schedule for the whole of the Works, the time for completing the major sections of the Works and his schedule for mobilizing the materials and equipment necessary for implementing the Works in a timely cohesive and efficient manner. The Contractor shall submit the above Resource Mobilization Plan on the basis of site/region prevalent labour constants/productivity factors and separately a Project Material Procurement Plan clearly mentioning the procurement strategy for long lead items.

2.2 **Slab Cycle Requirements**:

The Contractor shall plan and design Concrete Strength at various stages of work commensurate to the slab cycle requirements through submitted shuttering plan / design which shall be the sole responsibility of the Contractor and this shall not absolve him of his responsibilities despite approvals accorded by EIC.The quoted rate shall be deemed to include the cost of the above.

2.3 Project Review Meetings

The contractor, immediately on award of work shall submit details of his key personnel to be engaged for the work at site. In addition, he shall furnish the Engineer-in-Charge detailed organogram involved with the work.

The Contractor shall present the programme and status at various review meetings as required.

i) Weekly Review Meetings: Shall be attended by Local Team headed by Project -in-Charge.

Agenda	a) Weekly programme v/s actual achieved in the past week and programme for next week. b) Remedial Actions and hold up analysis. c) Client query approval.

ii) Monthly Review Meetings: Shall be attended by Project -in-Charge and the Management Representative who can take independent decisions.

Agenda	a) Progress Status/Statistics.	**3.0**
	b) Completion Outlook.	**4.0**
	c) Major hold ups / slippages.	**5.0**
	d) Assistance required.	
	e) Critical issues.	
	f) Client query/approval.	**6.0**
	g) Anticipated cash flow requirement for next two months	

7.0 WATER AND POWER

7.1 Water: Contractor shall make his own arrangement for water, required and suitable for construction. This shall also include arrangement of adequate water for hydro-tests of liquid/water retaining structures or any other installations as directed by EIC.

7.2 Power: Contractor shall make his own arrangements for power required for construction of the Project. Alternately, he may apply for and arrange power at the project site. All associated activities for obtaining necessary approvals and sanctions for construction power shall be coordinated by the contractor, the cost of which shall be deemed to be included in the quoted rates. All installations / fixtures & fittings / cabling for construction power shall be in the scope of the contractor without any additional cost to the NHIDCL. The delay on part of the Contractor in timely getting the statutory clearances and establishing required installation for adequate power supply shall not be accounted for extension of time and also shall not absolve him of Contractual responsibilities

7.3 If the NHIDCL/Employer provides water and electricity, the cost for such facility will be borne by the contractor at the prevailing rates of local Government bodies as per actuals.

8.0 MEASUREMENTS, BILLING & TERMS OF PAYMENT :

8.1 All works shall be measured in metric system based on actual work done as per the terms and conditions of the tender document.

8.2 Contractor shall submit computerized bills

8.3 **Terms of Payment**: Following shall be the terms of payments for the subject work:-

Running Account Bills:

The running bills shall be paid in stages. The above progressive payments are subject to deduction towards income tax and other recoveries as applicable as per the terms of the contract.

9.0 CONTRACT DRAWINGS

The contractor shall keep mandatorily one copy each of approved drawings, conditions of contract, specifications, instructions and schedule of quantities at the site of works available for reference by any authorized representative of Employer/Engineer- in-charge, at all times during the progress of the works. The drawings shall be displayed and arranged as directed by the Engineer- in-Charge.

10.0 WORK TO BE CARRIED OUT BY SPECIALISED AGENCIES:

10.1 Followingspecializedworksshouldbegotexecutedonlythroughagenciesspecializedin thefieldandthecontractorshallberequiredtosubmitthedetailsofsuchagenciesto the Engineer-in-Charge and obtain necessary approval prior to their engagement:-

- Anti-termite Treatment
- Water Proofing Work
- Structural Glazing
- Fire-fighting/fire suppression/ fire alarm systems
- Thermal insulation
- Plumbing with polypropylene pipes using advanced technology for jointing.
- Signages
- Installation of Slaughter line, Chiller line, equipment for Halal, Blood processing unit etc

10.2 The specialized agency should have successfully completed at least one work of similar nature.

10.3 The contractor shall submit the following details of the specialized agency before execution of work for approval of EIC :

List of similar works carried out by the agency during the last five years along with the name of work, name and address of clients, year of execution, value of work done and brief specification of the work. The credentials for such completed works shall be obtained from the Project Manager / Executive Engineer concerned along with contact address.

10.4 Notwithstanding the approval of the Engineer-in-Charge for the specialized agencies, the services of the specialized agencies shall be removed whereverthe Engineer-in-Charge is not satisfied with the performance of the specializedagency. Thereupon, the Contractor shall immediately arrange for an alternate specialized agency conforming to prescribed eligibility criteria. Nothing extra shallbe payable on this account. Further, no extension of time shall be permissible onthis account.

11.0 MOCK-UP

11.1 The concept of Mock Ups is to assess the performance parameters / quality standards specified for specified item in the project. The main objective of the section is to address issues prior to construction to minimize disruption to the critical path of construction program and is as follows;

- Determine whether the contractor possesses required skill level necessary to construct the activity, assemblies or systems such that the as-built construction will satisfy specified requirement.
- To understand the sequence of operation and discuss alternative sequencing options if any.
- To assess the standard of workmanship and aesthetics to be replicated throughout the project.
- To recognize and resolve potential areas of conflict prior to the commencement of construction.

11.2 The contractor shall prepare the full scale mock up at site for activity showing the following but not limited to:

- Flooring patterns, hardware, accessories, exterior windows(sill, corner, jamb),structural glazing, Doors, Glazing works, External Façade systems, false ceiling, electrical and mechanical fixtures, wall panelling system , false ceiling system etc.,

- To determine the acceptable standard of workmanship, the Contractor shall execute a sample unit (one of each type decided by the Engineer-in-charge) completing all items of works and services such as walls, floors, roof, plastering, joinery including fittings, sanitary fittings, plumbing, electrification, painting, entire kitchen and bathroom fittings, doors, windows, wood works, cabinets, cupboards and pelmets etc. complete in all respects. The brands of various materials incorporated as well as finishes will be approved by the Engineer-in-charge. These will be guiding samples for future execution of the rest of the Units.

11.3 The contractor shall construct mock ups for the purpose of testing as given in the particular specification for the following items of work:

- Semi Unitized Structural Glazing

11.4 Contractor shall build mock-ups for each form of construction and finish required, including materials indicated for the completed work as per given specifications.

11.5 Mock up shall be constructed by the same personnel who will be constructing actual construction of the said activity or system on the project along with acting site supervisors, key personnel during actual construction.

11.6 Contractor shall furnish the Mock up schedule taking care to ensure that sufficient time period is available between erection / installation of the mock up and actual execution of that item of work to enable EIC to incorporate changes and take corrective actions if any.

11.7 The Contractor shall establish the acceptable quality of workmanship as desired by the EIC for each of the items of the Works and their elements by preparing specimens and mock ups as directed by the EIC.

11.8 Nothing extra shall be payable for preparing the specimens and the mock ups. No claims of any kind whatsoever including the claim of extension of time will be entertained due to the incorporation of this requirement.

11.9 In case of non-approval of the mock-ups by EIC on account of quality issues or other reasons attributable to the Contractor, the mock ups shall be rebuilt up by the Contractor at no extra cost and time to EIC.

12.0 MATERIALS AND SAMPLES:

The contractor shall arrange a sample room at site for displaying approved samples which shall be maintained till the completion of the work. No payment will be made to the contractor for the samples procured.

The sample approval shall be given in writing by EIC within 15 days after submission of the sample with supporting catalogues and other documents as required by EIC.

The delay in submittal of the samples by the Contractor and further cascading delay in subsequent approvals and procurement shall not attract any extra cost and time to the Contract.

13.0 RECOMMENDED MAKES OF MATERIALS.

13.1 A list of recommended makes of materials is laced with contract

13.2 The order of preference amongst the various products/materials shall be as follows:

The products/materials shall be as per the Brand specified in the list of approved makes

If the Brand is not specified then the products/material shall be ISI marked and the same shall be got approved by the Engineer-in-Charge before execution.

If ISI marked product/material is not available, the same shall be as approved by the Engineer-in-Charge before execution.

13.3 In case of natural products such as Kota stone, Granite etc.,

a) The stones used shall be of premium grade and they shall be homogenous in colour with consistency in pattern, texture, tone, marking and colour. No discolouration, spots, fissures or cracks and pocked surfaces shall be allowed.

b) Where it is difficult to guarantee uniformity in colour and other properties, contractor shall make all efforts to match the colour, shade, texture of the product with the approved sample. If in the opinion of the Engineer-in-Charge there is significant variation in properties, the Engineer-in-Charge shall direct the

contractor to remove the same from the siteimmediately and replace with products matching with the approved sample within reasonable period. The decision of Engineer-in-Charge shall be final and binding. Nothing extra shall be paid on this account.

14.0 COMPLETION CERTIFICATES/ NOC FROM LOCAL STATUTORY BODIES

Contractor has to arrange at his own cost building/ work completion certificates or NOCs if required to be obtained, from the local statutory bodies of central and state govt. such as electrical, safety, Fire authority, Chief Controller of Explosives (CCOE) etc. Any fees required for obtaining such NOCs shall be paid by NHIDCL/Employer on production of relevant depository challans/ receipts from such Govt. authorities.

The application on behalf of NHIDCL/Employer for submission to relevant authorities along with copies of required certificates complete in all respects shall be prepared and submitted by the Contractor well ahead of time so that the actual construction / commissioning of the work is not delayed for want of the approval / inspection by concerned authorities.

The inspection of the works by the authorities shall be arranged by the Contractor and necessary co-ordination and liaison work in this respect shall be the responsibility of the Contractor.

15.0 COMPLETION DRAWINGS :

15.1 During the execution of the Works a set of drawings shall be retained in the Contractor's Site Offices for the exclusive purpose of recording approved changes made to the Work as the construction proceeds. On completion of the Work, the Contractor shall submit required details and "Mark- up" of changes if any in all drawings of the project to the EIC. The Contractor shall submit the "AS BUILT" drawings after completion of the project . These drawings shall include and show all the changes / deviations made from the approved working drawings during the course of construction and also the other details as called for by the Engineer-in-Charge.

16.0 TOOLS, PLANTS AND MACHINERY

The Contractor shall provide and install at site, T &P as stipulated in the Contract. The deployment of T&P shall be planned as per work requirement to suit the nature, quantum and speed of the work for lifting/hoisting construction materials/equipment etc. The T&P shall be maintained in good working condition throughout the progress of work. All adequate precaution regarding formal up keep of valid Statutory/Safety credentials of major construction equipment as directed by EIC, their installation, operation, maintenance, materials etc., shall be taken care of. The operating staff to be deployed shall be properly qualified and adequately trained and experienced. All safety precautions shall be taken during the project duration, against possible accident. The Contractor shall deploy his representative to effectively enforce the safety rules and regulations in this regard. Nothing extra shall be payable on this account for the above.

Construction Equipment & Mechanisation of Construction Activities

The above list is only minimal and indicative. The contractor shall deploy all necessary tools and plants as per the requirement of the work.

The Contractor shall without prejudice to his overall responsibility to execute and complete the work as per specifications and Time Schedule, progressively deploy adequate equipment, and tools & tackles and augment the same as decided by Engineer-in-Charge depending on the exigencies of the work so as to suit the construction schedule.

The Contractor shall mechanise the construction activities to the maximum extent by deploying all necessary construction equipment/ machinery in adequate numbers and capacities.

17.0 CENTRING AND SHUTTERING FOR R.C.C WORK:-

The work is to be completed in specified period hence the contractor shall adopt a suitable system complying with BIS standards regarding stripping time, with requisite number of sets of centring and shuttering. Nothing extra shall be payable on account of the above and the rates shall be restricted to the quoted rates for the corresponding item.

18.0 CEMENT & STEEL:

18.1 For Cement and Steel and other materials, as prescribed, the quantities brought at site shall be

entered in the respective material at site accounts and shall be treated as issued for maintenance of daily consumption.

18.2 The procurement of Cement and Reinforcement Steel, and, their issue and consumption shall be governed as per conditions laid down hereunder.

18.2.1 Cement

The Contractor shall procure 43 grade (Conforming to IS:8112) Ordinary Portland Cement, as required in the work, from reputed manufactures of cement, such as ACC, Ambuja, J K, JSW, adani, Shree, Ultratech, etc., as approved by Engineer-in-Charge. Procurement of cement of other type and grade shall be on prior approval of the EIC for specific area of application.

The Cement shall be brought at site in bulk supply as per requirement of work or as decided by the Engineer-in-Charge.

The cement godowns of the capacity to store appropriate quantity of cement as decided by the Engineer-in-Charge shall be constructed by the Contractor at site of work for which no extra payment shall be made. The Contractor shall facilitate the inspection of the cement godowns by the Engineer-in-Charge at any time.

18.2.2 Steel

Reinforcement steel shall mean Fe-500D unless otherwise specified. The Contractor shall procure steel reinforcement TMT bars (of Fe 500 D grade having elongation ratio more than 14.5%) conforming to IS:1786-2008 or latest / Structural steel conforming to IS:2062,from main producers of Steel like SAIL, TISCOetc., or as approved by the Engineer-in-Charge. The Contractor shall have to obtain and furnish test certificates to the Engineer-in-Charge in respect of all supplies of steel brought by him to the site of work. The structural steel, reinforcement steel shall be stored by the Contractor at site of workstrictly on hard elevated bed or wooden sleepers enclosed within demarcated area (fabrication yard, reinforcement yard)in sucha way as to prevent distortion, corrosion and nothing extra shall be paid on this account. Bars of different sizes (diameters) and lengths shall be stored separately away from the scrapsto facilitate easy counting and checking.

Coefficient of weight i.e. the weight per unit length of the steel procured by the Contractor shall be ascertained at site before using it and certified by the Engineer-in-Charge. In case, weight per unit length is beyond the rolling margin as laid down in the BIS: 1786 / IS:1852 for reinforcement steel / structural steel respectively, the steel will be rejected and shall be removed from the site of work forthwith. In case weight per unit length is more than the standard coefficient of weight for the diameter, but is within the rolling margin, thenthe payment shall be made as per the standard weight per unit length, and, where the weight per unit length is lesser than the standard coefficient of weight for the diameter, but is within the rolling margin, the payment shall be restricted with respect to the actual weight per unit length of the diameter.For this Coefficients indicated in CPWD Specifications or any other BIS Standards shall be adopted.

The standard sectional weights referred to in standard table under para 5.3.4, of the CPWD Specifications 2019 are to be considered for conversion of length of various sizes of Steel Reinforcement bars into weight and are as per clause 6.2 of IS 1786.

18.3 The actual issue and consumption of steel and Cement on the work shall beregulated and proper accounts maintained as provided in clause 10 of the contract. The theoretical consumption of steeland cementshall be worked out.

18.4 Steel and Cement brought to site and remaining unused shall not be removed from site without the written permission of the Engineer-in-Charge.

19.0 ITEMS OF WORK REQUIRING PERFORMANCE GUARANTEE BOND

The following items of works require submission of performance guarantee bond:

A. External Façade (Structural glazing)

B. Water proofing treatment system
C. Anti-termite treatment

For the above works , the Contractor shall give a guarantee to the effect that the work shall remain structurally stable and shall guarantee against faulty design, workmanship, fabrication, erecting, installation, leakages etc including defective material, if any. The Contractor shall furnish a Guarantee Bond, as per prescribed format. The Guarantee Period shall be for 10 (Ten) years after completion of defect liability period.

20.0 REPORTS TO BE SUBMITTED

The Contractor shall prepare and submit monthly progress reports (Including Progress Photographs) for the month to the EIC in three copies within first 7 days of the following /next month. Reporting shall continue until the Contractor has completed all work including the outstanding work as on the completion date as stated in the Taking-Over Certificate for the Works. Each report shall include but shall not be limited to the following:

(a) the status of supply and delivery of major materials and Plant to be incorporated in the Works, and the supply of major items of the Contractor's construction plant;
(b) records of personnel and Contractor's equipment on site;
(c) Activities executed/achievements during the month.
(d) Copies of quality assurance documents, test results and certificates of materials;
(e) Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
(f) Comparisons of actual and planned progress, with details of any aspects which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome such aspects.
(g) Areas of concern/problems/hold ups& its impact and action plans
And any other reports sought by the EIC.

21.0 QUARRY MATERIALS

The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, gravel, murrum, etc., and to make his own arrangements(within the contract price) for collection and transportation of the materials irrespective of the leads and lifts required. The party managing the quarry identified by the Contractor should have proper license from the UT of Ladakh. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications contained in this Bid and shall be subject to the approval of the EIC. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account. All the seignorage (royalty)charges, levies etc., payable to Government shall be paid by the Contractor and are deemed to be included in the contract price.

22.0 INTERFERENCE WITH TRAFFIC AND ADJOINING PROPERTIES/BUILDINGS

22.1 The Contractor shall prepare General Maintenance of Traffic Plan which will be subject to the approval of the EIC. In case any operation connected with the Works requires temporary diversion of the traffic, or obstruction or closure of any road, or any other 'right of way', the approval of the EIC and the respective competent authorities shall be obtained at least one week in advance.

22.2 The Contractor shall at all times during execution of the Works, ensure an uninterrupted flow of traffic/occupants of existing buildings on the work locations.

22.3 The Contractor shall at all times during execution of the Works, provide convenient access to parts, steps, bridges or drives for all entrances to property abutting the work sites and maintain them clear, tidy and free from mud or objectionable matter.

22.4 If in order to avoid undue interference with the traffic and adjoining properties, the EIC instructs the Contractor to take special precautions or work within restricted time periods; the Contractor shall carry out the Works during such time and in such manner as directed by the EIC.

22.5 The Contractor shall not claim any extra cost or payment on account of all or any of the works specified in above clauses.

23.0 CONTRACTOR TO CO-ORDINATE HIS WORK WITH OTHER CONTRACTORS

Various other works may be progressing simultaneously in the project site. The Contractor shall co-ordinate with the other concerned Contractors and take into account the inter-relation with other works while planning his daily construction activities, so as to eliminate any hindrance to any work(s) and/or to avoid any damages to the work(s) already carried out by other Contractors. The Contractor shall co-ordinate with the other concerned Contractors for all such works as per the Engineer's directions at no extra cost and he shall provide unhindered access to the T&P and machinery of the other contractors as per the directions of EIC.

24.0 SHIFTING OF UTILITY LINES

During the course of execution of the Works under this Contract, the Contractor is bound to undertake shifting of any Utility line(s) that are required to complete the Works satisfactorily. However, NHIDCL reserves the option to get such work carried out by other agency, but this shall not relieve the Contractor of any of his responsibilities and obligations under this Contract implying that this shall not be treated as compensation event for extension of time unless otherwise consented by EIC.

25.0 MOBILISATION OF MEN, MATERIALS AND EQUIPMENTS:

All expenses towards mobilization at site and demobilization including bringing the equipment, work force, materials, dismantling the equipment, clearing the site etc. shall be deemed to be included in prices quoted and no separate payments on account of such expenses shall be entertained.The EIC shall have exclusive rights to accept or reject any material or equipment and also the manpower engaged by the Contractor during complete tenure of the Project. This can also lead to demobilisation of the supervisory manpower including key persons of the Contractor/Specialized agency in case of their non-satisfactory performance.

26.0 LIGHTING& WATCH AND WARD:

26.1 The contractor shall at his own cost take all precautions to ensure safety of life and property by providing necessary barriers, area lighting at the construction site and approaches, watchmen etc. during progress of work at all hours including night hours, if required, as directed by the Engineer-in-charge.

26.2 The Contractor shall be responsible for the watch and ward of the all construction premises and buildings, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures provided by him against pilferage and breakage during the period of installation till handing over of all the works to NHIDCL/Employer. Nothing extra shall be payable on this account.

27.0 TENDER DRAWINGS

The hard copies of tender drawings are not being attached with the tender documents. Soft copies are uploaded along with bid document on CPPP/NHIDCL website. The bidders are required to go through the drawings before bidding for the work. A set of the drawings is available in the office of the NHIDCL, which the contractor may study during working hours, before quoting the rates if he so desires.

28.0 APPLICABLE PERMITS

28.1 The contractor(s) shall give to the Municipality, police and other authorities all necessary notices etc. that may be required by law and obtain all requisite licenses for temporary obstructions, enclosures etc. and pay all fee, taxes and charges which may be levied on account of these operations in executing the contract. He shall make good any damage to the adjoining property whether public or private and shall supply and maintain lights either for illumination or for cautioning the public at night.

28.2 The Contractor shall ensure that applicable permits mandated by the local bodies are obtained as required under the Applicable Laws. An indicative but not exhaustive list of some of the applicable permits is mentioned below for the guidance of the Contractor.

28.3 Consequences on account of failure to obtain the mandatory permits shall be the sole responsibility of the contractor and no claim what so ever shall be entertained by the EIC. Any liability incurred by EIC on account of such failure shall be recovered from the amounts/ payments due to the Contractor.

- Permission of the UT Government for extraction of boulders from quarry;
- Permission of Pollution Control Board for installation of crushers;
- Permission of the UT Government for drawing water from river/reservoir;
- Licence from Inspector of factories or other competent authority for setting up Batching Plant;
- Clearance of Pollution Control Board for setting up Batching Plant;
- Clearance of Pollution Control Board for Asphalt Plant;
- Clearance of Pollution Control Board for installation of diesel generator sets;
- Fire safety clearance from fire authorities;
- Permission of UT Government for cutting of trees, if any;
- Permit for employing unskilled/semiskilled labour during day/night;
- Permitfordismantling/reconstruction/underpinning/strengthening of affected structures, disposal of solid waste/excess material or soil, setting up of temporary campus on government/private/leased land;
- Clearance for any urban structure affecting the landscape/ environment from the concerned authority;
- Permission from Archaeological Survey of India for construction of any structure within the prescribed radius of protected monuments;
- Permissions from the public utilities for diversion of utilities including reinstatement/reconstruction to original specifications;
- Approvals for electric supply/distributions;
- Approval of Traffic Police for diversions and running of vehicles on specified routes; and
- Any other permits or clearance required under the Applicable laws.

29.0 QUALITY ASSURANCE

Detailed quality assurance programme is to be followed for the execution of Contract under various divisions of works will be mutually discussed and agreed to.

The Contractor shall establish document and maintain an effective quality assurance system as outlined in recognised codes.

Quality Assurance System plans/procedures of the Contractor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the quality assurance, plans or procedures to be followed for quality control in respect of all the activities envisaged in the construction works. The quality assurance system should indicate organisational approach for quality control and quality assurance of the construction activities, at all stages of work at site.

NHIDCL or their representative shall reserve the right to inspect/witness, review any or all stages of work at site as deemed necessary for quality assurance and / or timely completion of the work.

The Contractor has to ensure the deployment of quality Assurance and Quality Control Engineer(s) depending upon the quantum of work. This QA/QC group shall be fully responsible to carryout the work as per standards and all codes' requirements. In case EIC feels that Contractor's QA/QC Engineer(s) are insufficient, Contractor has to deploy other experienced Engineer(s) as per site requirement and to the full satisfaction of EIC.

30.0 INSURANCE

Without limiting the Contractor's obligations and responsibilities stated elsewhere in the Contract, the Contractor shall at his own cost arrange, secure and maintain insurance in the joint names of NHIDCL and the contractor with any of the subsidiary of the General Insurance Corporation of India in such a manner that NHIDCL and the contractor are covered for all time during the period of contract i.e. the time period allowed for completion of work, extended period and the defect liability period. The insurance shall be effected in accordance with terms approved by NHIDCL and the contractor shall submit the insurance policies to the Engineer-In-Charge within 15 (Fifteen) days of signing of the agreement along withthe receipt of premium. The contractor shall timely pay and submit the receipts of payment of premiums for extensions of policies, if any. The insurance shall coverthe following: -

1. Contractor's All Risks Insurance

The contractor shall insure the work for a sum equivalent to the Contract value or such additional sums as specified and the interests of NHIDCL against ALL RISKS claims, proceedings, loss or damages,

costs, charges and expensesfromwhatsoever cause arising out of or in consequence of the execution and maintenance of the work for which the contractor is responsible under the contract

2. Workman Compensation & Employers Liability Insurance.

This insurance shall be affected for all the contractor's employees engaged in the performance of the contract. NHIDCL shall not be liable in respect of any damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or anyother person in the employment of the contractor and the contractor shall indemnify and keep indemnified NHIDCL against all such damages and compensation and against all claims, demands, proceedings, costs, charges andexpenses, whatsoever in respect or in relation thereof.

3. Third Party Insurance.

The contractor shall be responsible for making good to the satisfactionof the Engineer-in-Charge any loss or any damage to all structuresand properties belonging to Employer or being executed or procured or being procured by Employer or of the other agencies within the premises of all work of NHIDCL if such loss or damage is due to fault and or the negligence or wilful acts or omissions of the contractor, his employees, agents, representatives.

The contractor shall take sufficient care in moving his plants, equipment and materials from one place to another so that they do not cause any damage to any person or to the property of Employer or any third party including overhead and underground cables and in the event of any damage resulting to the property ofthe NHIDCL or to a third party during the movement of the afore said plant, equipment or materials, the cost of such damages including eventual loss of production, operation or services in any plant or establishment as estimated by the NHIDCL or ascertained or demanded by the third party, shall be borne by the contractor.

a) Before commencing the execution of the work, the contractor, shall insure and indemnify and keep NHIDCL harmless of all claims, against thecontractor's liability for any materials or physical damage, loss or injury which may occur to any property, including that of Employer or to any person including any employee of NHIDCL/Employer, or arising out of the execution of the work or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to (a) above. Such insurance shall be effected for an amount sufficient tocover suchrisks. The terms shall include a provision whereby, in the event of any claim being brought or made against NHIDCL the insurer shall indemnify NHIDCL against such claims and anycosts, charges and expenses in respect thereof.
b) The contractor shall also at times indemnify NHIDCL against all claims, damages or compensation under the provisions of Payment or Wages Act,1936, Minimum Wages Act, 1948, Employer's Liability Act, 1938, theWorkman's Compensation Act,1947, Industrial Disputes Act,1947 and Maternity Benefit Act, 1961, or any modification thereof or any other law relating thereof and rules made there under from time to time.
c) Contractor shall also at his own cost carry and maintain any and all other insurance(s) which he may be required to take out under any law or regulation from time to time. He shall also carry and maintain any other insurance, which may be required by the Engineer-in-Charge.
d) The Contractor shall prove to the Engineer-in-charge fromtime to time he has taken out all the insurance policies referred to above and has paid the necessary premiums for keeping the policies alive till expiry of the Defects Liability Period.
e) The aforesaid insurance policies shall provide that they shall not be cancelled till the Engineer-in-charge has agreed for cancellation.

4. Remedy on the contractor's failure to insure

If the contractor shall fail to effect and keep in force the insurance referred to above or any other insurance which he/they may be required to effect under the terms of the contract then and in any such case Engineer-in-charge may without being bound to, effect and keep in force any such insurance and pay such premium or premiums, as may be necessary for that purpose and from time to time deduct the amount so paid by the Engineer-in-charge from any moneys due or which may become due to the contractor or recover the same as a debt due from the contractor.

31.0 INDEMNITIES

(a)The Contractor shall indemnify and hold harmless the NHIDCL, the NHIDCL's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and

expenses) in respect of:

(a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable toany negligence, wilful act or breach of the Contract by the NHIDCL, the NHIDCL's personnel, orany of their respective agents, and

(b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the NHIDCL, the NHIDCL's personnel, their respective agents, or anyone directly or indirectly employed by any of them.

SPECIAL CONDITIONS OF CONTRACT

(ELECTRICAL SERVICES)

32.0 GENERAL

32.1 These special conditions shall be read in conjunction with general conditions of contract and amendments / corrections thereto, Special Conditions of Contract for Civil Works.

32.2 The Internal electrical works shall be carried out in accordance with the CPWD General Specifications for Electrical works (Part–I–Internal) 2013 and (Part-IIExternal)1994, HVAC Specifications 2017 other Relevant latest CPWD Specifications (Part-III to Part VII), Indian Electricity Rules,Relevant Indian Standard and Additional terms and conditions and specifications attached herewith.

32.3 The contractor must study carefully all the specifications/schedule of work / drawings / additional specifications and site parameters and quote his bid after accounting all works. No extra claim on any account shall be paid/ entertained other than the quoted rates.

32.4 The work shall be carried out in accordance with the drawings approved by the Engineer-in-charge. Before commencement of any item of work, the contractor shall correlate all the relevant architectural and structural drawings approved for the work and satisfy himself that the information available is complete and unambiguous. The discrepancy, if any, shall be brought to the notice of Engineer-in-charge before execution of work. The contractor himself shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information.

32.5 The contractor shall leave such recesses, holes, openings, etc., as may be required for the electric, air-conditioning and other related works. For this purpose any required inserts, sleeves, brackets, conduits, base plates, clamps etc. shall be arranged by the contractor and fix the same at the time of casting of concrete, stone work & brick work, if required, and nothing extra shall be payable on this account.

32.6 The contractor shall give a trial run of the equipment and machinery for establishing its capability to achieve the specifications within laid down tolerances to the satisfaction of the Engineer-in-charge before commencement of work.

32.7 All tools, plant and machinery provided by the contractor shall, when brought at the site, be deemed to be exclusively intended for the construction and completion of this work and the contractor shall not remove the same or any part thereofwithout the consent of the Engineer-in-charge.

32.8 All materials shall be got checked by the Engineer-in-charge on receipt of the same at site before use.

32.9 Samples of all materials,conduits, accessories, switches, wires, control cables fittings and other materials/articles required for execution of the work shall be got approved from the Engineer-in-charge prior to procurement. Materials/articles manufactured by the firms of repute as indicated in tender documents and approved by the Engineer-in-charge shall only be used.

32.10 These shall be submitted for approval and retention by Engineer In-charge/his representative and shall be kept in their site office for reference and verification till the completion of the Project.

32.11 The contractor shall be required to make a sample of each item of work at the earliest opportunity using all approved materials for approval of Engineer in charge before mass scale finishing works are taken up.

32.12 Even ISI marked materials shall be subjected to quality test at the discretion of the Engineer-in-charge besides testing of other materials as per the specifications described for the item/material. Whenever ISI marked materials are brought to the site of work; the contractor shall, if required by the Engineer-in-charge, furnish manufacturers test certificates to establish that the material procured by the contractor for incorporation in the work satisfy the provisions of IS codes relevant to the material and/or the work done.

32.13 The Contractor shall use only chase cutting machine for cutting the chases in the wall for recessed conduit wiring.

32.14 The contractor will have to ensure that the skilled labour i.e. wireman etc., engaged in the execution of the work must possess valid electrical license, otherwise he will not be permitted to execute the work.

32.15 The contractor shall be responsible for removal of all defects in the work during the guarantee/warranty period. If any failure is noticed during this period which is attributable to poor quality of material and bad workmanship, the contractor will be required to rectify the same at his own cost, failure of which the NHIDCL will be at liberty to get the defects rectified at the risk & cost of the contractor. The contractor will also be required to carryout his own inspection/testing during the guarantee/warranty period and attend to any defect taking place during this period.

32.16 Guarantee: All material shall be guaranteed for a period of Twelve (12) months from the actual date of actual completion of the overall project by the Contractor against unsatisfactory performance and/or break down due to defective design, workmanship of material. The material or equipment or any other there of so found defective during guarantee period shall forthwith be repaired or replaced free of cost, to the satisfaction of the Engineer-in-charge. In case it is felt by the NHIDCL/Employer that undue delay is being caused by the contractor in doing this, the same will be got done by the NHIDCL at the risk and cost of the contractor. The decision of Engineer-in-charge in this regard shall be final & binding.

ASSOCIATED CIVIL WORKS

All Major or Minor civil works associated with M&E installation are included in the scope of this contract including all minor civil work like wall chasing by wall chaser, making holes etc. for installation of conduits/cables and making good. These shall be executed in accordance with approved shop drawings.

PERFORMANCE GUARANTEE

The contractor shall carry out the work in accordance with the approved Drawings, Specifications, Schedule of Quantities and other documents forming part of the Contract.

The contractor shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result.The contractor shall guarantee that the M&E system as installed shall perform to complete satisfaction of the NHIDCL.

Complete set of tender drawings is available in the NHIDCL's office and reference may be made to same for any details or information. The contractor shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

BYE-LAWS AND REGULATIONS

The work shall be carried out to the satisfaction of the Engineer-in-charge and in accordance with the Specifications, Regulations of the Electric Supply Authority, Indian Electricity Rules and Regulations, latest Indian Standards and as per the requirements of the Chief Fire Officer etc.,

FEES AND PERMITS

The Contractor shall obtain permits required for the installation of this work. On completion of the work, the contractor shall obtain and deliver to the NHIDCL/Employer, certificate of final inspection and approval by the local electricity authority for substation, DG sets, HSD storage system, fire detection system, fire fighting and Lifts (CFO/ Municipal, UT/Central govt. whichever is applicable).
The contractor or his representative shall attend such inspection and extend all test facilities as are considered necessary, rectify and comply with all observations of the Inspectors which are part of the agreement and arrange for obtaining necessary clearance certificate in favour of the department. In case the contract or fails to attend the inspection and make desired facilities available during inspection, the department reserves the right to provide the same at the risk and cost ofthe contractor and impose penalty for the same. The installation will be accepted by NHIDCLonly after receiving clearance from respective Inspectors, for the work executed by the contractor under the agreement.

Any extra work for obtaining approval from CFO etc, shall be carried out with out any extra cost to the NHIDCL. However, any fee spayable to CFO for the clearance shall be made by the NHIDCL/Employer.

DRAWINGS

The Electrical Tender Drawings issued with tenders (if any), are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Tender Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Tender Drawings. The architectural / interiors drawings and details shall be examined for exact location of equipment, electrical points & fixtures.
The contractor shall follow the tender drawings in preparation of his bid drawings/shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.
The contractor shall examine all architectural, structural, plumbing, HVAC, Electrical and other services drawings and check the as-built works before starting the work and report to the Engineer-in-charge any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Engineer-in-charge without additional cost to the NHIDCL.

FABRIACTION/SHOP DRAWINGS

7.1 All the fabrication drawings shall be prepared on computer using Autocad software based on Architectural Drawings, site measurements and Drawings. Within eight weeks of the award of the contract or as specified in Special Conditions of relevant item of work, the contractor shall furnish, for the approval of the EIC, four sets of detailed drawings of all equipment and materials including layouts for all conduit layouts, distribution panels, switch boards, cabinets, special pull boxes, cable trays and any other requirement to be fabricated or purchased by the contractor. Drawings shall also be submitted in soft format.

7.2 These drawings shall contain all information required to complete the Project as per specifications and as required by the Engineer-in-charge. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each drawing shall contain tabulation of all measurable items of equipment/materials/ works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all drawings.

Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the approved makes list.

When the EIC makes any amendments in the above drawings, the contractor shall supply four fresh sets of drawings with the amendments duly incorporated along with check print, for approval. The contractor shall submit further six or as many sets as required by EIC of shop drawings to the Engineer-in-charge for the exclusive use by the Engineer-in-charge and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.

7.3 fabrication drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material to allow the Engineer-in-charge ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce fabrication drawings at the right time, in accordance with the approved programme.

7.4 Manufacturers drawings, catalogues, pamphlets and other documents submitted for approval shall be in six sets. Each item in each set shall be properly labelled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

7.6 Approval of Fabrication drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

7.7 Where the contractor proposes to use an item or equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, wiring or any other part of the mechanical, electrical or architectural layouts; all such re-design, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the EIC.

MANUFACTURERS INSTRUCTIONS

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, manufacturer's instructions shall be followed in that case duly bringing the same to the notice of EIC.

COMPLETION CERTIFICATE

On completion of the electrical installation a certificate shall be furnished by the Contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local, UT/central govt./ municipal / fire authorities concerned.

INSPECTION AND TESTING

Inspection and testing DG sets and other major items at manufacturer's works for this contract is t at discretion of NHIDCL. Inspection team for the same may be constituted by NHIDCL. No equipment shall be delivered without prior written confirmation from the Engineer In-charge. All expenses related to testing at their or their sub vendor's works shall be to Contractor account.

Tests on site of completed works shall demonstrate the following:

That the equipment installed complies with specification in all respect and is of the correct rating for the duty and site conditions.

That all items operate efficiently and quietly to meet the specified requirements.

That all circuits are fully protected and that protective devices are properly co-ordinated.

That all non-current carrying metal parts are properly and safely grounded in accordance with the specification and appropriate Codes of Practice.

The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Owner and shall provide test certificate signed by a authorised person. Such test shall be conducted on all materials and equipment and tests on completed work as called for by the Owner at contractor's expenses unless otherwise called for.

If it is proved that the installation or part thereof is not satisfactorily carried out then the contractor shall be liable for the rectification of the same. NHIDCL's decision as to what constitutes a satisfactory installation shall be final.

COMPLETION DRAWINGS

Upon completion of the work and before issuance of completion certificate, the contractor shall submit to the NHIDCL four sets of layout drawings in progressive manner for individual systems drawn at approved scale indicating the complete wiring system as installed. Drawings shall be prepared on AUTO-CAD (latest version) . Along with the hard copies, the contractor shall submit copies of all drawings on CD and one set of all drawings on RTF shall also be submitted. These drawings must provide:

a. All power distribution panel layout.
b. Single line power distribution diagram including control wiring.
c. Cable Trays with number and size of cables installed.
d. Run and size of conduits, inspection, junction and pull boxes.
e. Raceways and Junction Boxes.
f. Number and size of conductors in each conduit with phase identification.
g. Location and rating of sockets and switches controlling the lighting and power outlets.
h. Location and details of distribution boards/panels, mains, switches along with phase balancing details.
i. A complete wiring diagram as installed and single line diagrams showing all connections in the complete electrical system.
j. Location of all earthing stations, route and size of all earthing conductors manhole.
k. Layout and particulars of all HT & LT cables.
l. Instruction, maintenance and operation manuals including maintenance schedule for all equipment. Testing & commissioning reports of all electrical equipment.

And any other drawing/document as required.

OPERATING INSTRUCTION & MAINTENANCE MANUAL

Upon completion and commissioning of part Mechanical & Electrical system **t**he contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten /printed operating instructions and maintenance manuals; one each for retention by NHIDCL and Employer's representative and two

for Employer's Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for Four(4) year period of maintenance of each equipment.

ON SITE TRAINING

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labour and helpers for operating the entire installation for a period of thirty (30) working days of eight (8) hours each, to enable the Employer's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Employer's personnel in the operation, adjustment and maintenance of all equipment installed**.**

MAINTENANCE DURING DEFECTS LIABILITY PERIOD

14.1. Complaints

The contractor shall set up a single point contact (SPO) to receive complaints during the effect liability period. It shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 48 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

14.2. Repairs

All equipment that requires repairing shall be immediately serviced and repaired. During the period of the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Employer.

UPTIME GUARANTEE

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall.

The Contractor shall provide log formats in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all temperatures, pressures, humidity, power consumption, starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

DEMONSTRATION TO NHIDCL/EMPLOYER

At completion, devices subject to manual operation shall be operated at least five times in presence of Engineer In-charge/ his representative to demonstrate satisfactory operation.

SITE CONDITIONS

Outside Design Date(Peak)

Location (s) : As stated in NIT
Temparature in Winter (DB/WB): -25 to -30 Degree Celicius
Summer(DBT/WBT): 23.8 to 38 Degree Celisius

Desired Inside Conditions:

A) In Winter : 22+/-1 Degree Celsius
   Relative Humidity: 30% Approx.
B) In Summer : 24 +/- 1 Degree Celsius
   Relative Humidity : 40% Approx.

SPECIAL CONDITIONS OF CONTRACT FOR EI & FANS

The special conditions shall be read in conjunction with general conditions of contract and amendments / corrections thereto, Special Conditions of Contract for Civil Works. If there are any provisions in these special conditions, which are at variance with the provision in the above-mentioned documents, the provisions in these special conditions shall take precedence.

18.1 DRAWINGS TO BE SUBMITTED FOR APPROVAL:

The firm shall supply the following shop drawings within 30 days after award of the work as detailed below.

- Drawing showing the position of fittings, including Emergency fittings, switches boards and plug points etc.
- Detail drawings showing location of DBs with phase balancing details.
- Schematic diagram showing all connections in the complete electrical system.
- Location drawings of rising main, cable trays, raceways layouts and junction box with necessary catalogues.
- Drawings showing the position of Advance Lightning conductor Air terminal, Down conductor, Spike counter and Earth pits.
- Drawing showing the location of Signage lighting Fire Escape route lighting including common control at Ground floor

18.2 INSPECTION:

NHIDCL reserves the right to carry out inspection and testing at manufacturer's works for any equipment/item prescribed in this contract. Samples of materials like accessories, switches, conduit, wire etc shall be submitted to NHIDCL for approval.

18.3 TESTING AT SITE:

Following tests shall be carried out at site as per CPWD specifications and report submitted to the Engineer-in-charge.The installed system shall be tested by the NHIDCL Representatives.

18.4 COMPLETION OF WORK OF EI & FANS:

a) Date of completion of work for the Electrical Installation (Internal Electrical Installation) shall be the last date of successful testing and commissioning of the installations by NHIDCL Representatives.

b) The above date shall be the date of completion of Work only for the purpose of settlement of bills / payments. However the guarantee period shall start from the actual date of completion of overall project. The Security Deposit shall be released after the successful completion of Defects Liability Period.

18.5 COMPLETION DRAWINGS:

The Contractor shall supply four sets of drawings/documents after completion of the work as detailed below:

- Drawing showing the position of fitting, including Emergency fittings switches boards and plug points etc.
- Detail drawings showing location of DBs with phase balancing details.
- Schematic diagram showing all connections in the complete electrical system.
- Location drawings of rising main, cable trays, raceways layouts and junction box.
- Drawings showing the position of Advance Lightning conductor air terminal, Down conductor, Spike counter and Earth pits.
- Drawing showing the location of Signage lighting Fire Escape route lighting including common control at Ground floor

SECTION-X

SCOPE OF WORK & TECHNICAL SPECIFICATIONS

Scope of Work

The responsibility of investigations, designing, planning, procurement, construction, safety, quality, and risk of engineering lies with the contractor. The Scope of work under this Contract includes construction of following structures in all respects as per tender drawings/approved working drawings/finishes matrix/Schedule of quantities/Technical and Particular Specification/Conditions and Special Conditions of Contract:

The detailed scope of work is given below:

1. Preparations of working drawings of Architectural/Structural design and drawings/PHE/Electrical/ landscaping/all other services and obtain approval of the Engineer-in-Charge for execution. The structural design and drawings shall be vetted from IITs/NITs/Govt. Engineering College or any other approved institution before execution at contractor's own cost.
2. Excavation and Top soil preservation.
3. Soling and PCC for all rafts/footings/basement grade slab as specified in drawings
4. RCC Raft/isolated/combined Foundation and RCC retaining walls. Minimum grade of concrete for all structural members shall be M25 with 100% OPC/PSC as cementitious material.
5. The RCC structure shall be designed confirming to BIS 1893 code (Earth Quake Resistant Design).
6. Expansion joints in the structure shall be as proposed in the tender drawings .The expansion joints(for columns and beams)filler board shall be provided with highly compressible bitumen-free boards (HD 100 of Supreme or approved equivalent).
7. Backfilling and Compaction as per approved drawings
8. RCC substructure, basement with RCC grade slab and superstructure including staircase
9. Plinth beam and plinth area construction
10. Masonry in precast Concrete Block as per specifications
11. Internal(single coat) and External(two coats) plaster with cement mortar
12. Water supply system including plumbing fittings, water meter. Water supply system shall be designed considering the extreme minus low temperature of -25^{o}C to -35^{o} C that prevail in winters in Leh to ensure round the year water supply to all end points of the distribution system.
13. Drainage & Sanitary fixtures: Drainage pipes and its protection system shall be designed considering the extreme minus low temperature of -35^{o} C that prevails in winters at sites to ensure round the year blockage-free drainage system
    i. Sanitary fittings: The sanitary fixtures & fittings shall be of approved makes and duly approved by Engineer-in-Charge. In general following fixtures shall be provided:
       - EWC: Wall hung with cistern
       - Wash basins with single hole basin mixture
       - All sanitary fittings will be CP brass fittings
14. All the materials should be procured as per enclosed specification.

Fire Detection & Alarms System:

Complete Analogue Addressable, zoned and electrically supervised, Class A, multiple loops Fire Alarm and Detection system, including initiating device and notification appliances shall be provided for all Buildings. The Fire detection and alarm system shall be consisting with the following,

- Addressable analogue Fire detection & alarm control panel.
- Smoke & heat detectors
- Manual pull stations (break glass type)
- Electronic Hooters cum strobes

Fire Extinguisher:

The portable fire extinguishers shall be provided as per NFPA 10, standards for portable fire extinguishers. Portable fire extinguishers will work as intended to provide a first line of defence against fires of limited size. The following classes of Fire extinguisher are considered as per NFPA 10.

Class A fire extinguishers are considered for ordinary combustibles such as wood, cloths & Plastic. This fire class requires the heat-absorbing effects of water or the coating effects of certain dry chemicals. According to NFPA, extinguishers suitable for Class A fires should be identified by a triangle containing the letter "A." If in color, the triangle should be green.

Class B fire extinguishers are considered for flammable liquid and gas fires such as HSD &petroleum greases etc. These fire extinguishers deprive the fire of oxygen and interrupt the fire chain by inhibiting the release of combustible vapors. According to NFPA, extinguishers suitable for Class B fires should be identified by a square containing the letter "B." If in color, the square should be red.

Class C fire extinguishers are considered on fires that involve live electrical equipment that require the use of electrically nonconductive extinguishing agents. Once the electrical equipment is de-energized, extinguishers for Class A or B fires may be used. According to NFPA, extinguishers suitable for Class C fires should be identified by a circle containing the letter "C." If in color, the circle should be blue.

TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS OF WORKMANSHIP AND MATERIALS FOR BUILDING & CIVIL CONSTRUCTION

GENERAL

1.1 General Materials

1.1.1 The work shall in general conform to the Latest CPWD Specifications Volume-I and Volume-II 2019 (corrected up to the last date of submission/uploading of bid). Work under this Contract shall consist of furnishing all labour, materials, equipment, tools & plants and appliances necessary and required. All materials used in the permanent works shall be of the best quality of the kind and to the approval of the Engineer-in-Charge. Any material not covered by these Specifications, shall comply with the relevant latest Indian Standard Specifications (Referred to as IS as revised or modified up-to the date one month prior to Tender date). For materials not specified in the aforesaid, direction of the Engineer-in-Charge shall be followed. All disputes shall be referred to the Employer, whose decision shall be final and binding.

1.1.2 Samples of materials to be supplied and used, by the Contractor in the works shall be to the prior approval of the Engineer-in-Charge. For this purpose the Contractor shall furnish in advance representative samples in quantities and in the manner as directed by the Engineer-in-Charge for his approval. Materials brought to the Site, which in the option of the Engineer-in-Charge do not conform to the approved sample, shall, if so directed by him, be removed by the Contractor from the Site and replaced by the materials of approved quality.

1.1.3 In spite of approval of the Engineer-in-Charge of any materials brought to the site, he may subsequently reject the same if in his opinion the materials has since deteriorated due to long or defective storage or for any reason whatsoever and is thereby considered unfit for use in the permanent works. Any material thus rejected shall be immediately removed from the Site at Contractor's cost and expense.
1.1.4 All materials brought to the Site shall be properly stored and guarded in the manner as directed by the Engineer-in-Charge and to his satisfaction.
1.1.5 The Engineer on written request of EIC may carry out test of materials as he may decide. The Contractor shall, at his cost and expenses, for this purpose supply requisite materials and render such assistance to the Engineer-in-Charge as he may require.

1.2 Workmanship
All works are to be carried out in proper workman like manner. Items of works not covered by these Specifications or by other tender documents shall be carried out as per best practice according to the direction of the Engineer-in-Charge and to his satisfaction. The relevant IS Specifications shall be taken as guide for the purpose.

1.3 Works Included
The rates for all items, unless specifically stated otherwise in the Contract, must cover the cost of all materials, labour, tools, machinery, plant, pumps, scaffolding, staging strong props, bamboos, ropes, templates, pages and all appliances and operations whatsoever necessary for efficient execution of work.

1.4 Setting Out and Levelling
The Contractor is to set and level the works, and will be responsible for the accuracy for the same. He is to provide all instruments and proper qualified staff required for checking the Contractor's work.

1.5 Safety
The Contractor shall take adequate precaution to provide complete safety for prevention of accidents on the site.

1.6 Keeping Works Free from Water
The Contractor shall provide and maintain at his own cost, electrically or other power driven pumps and other plant and equipment to keep site excavated foundation pits and trenches free from surface as well as subsoil/leakage water from any other source thereof and continue to do so to the complete satisfaction of the Engineer-in-Charge till the site is handed over. Method of dewatering shall need approval of the Engineer-in-Charge but no payment whatsoever is allowed on this count.

1.7 Rubbish
1.7.1 The Contractor shall clear all rubbish, vegetation, roots, soda etc.and dump them in the area indicated to the satisfaction of Engineer-in-Charge. No separate rate shall be allowed for the above work.
1.7.2 After the work is completed, the Contractor shall clear the area surrounding the buildings, all hutments and excess stores and remnants of building materials such brick bats, metal, sand, timber, steel etc.

1.8 Inspection
The Contractor shall inspect the Site of works and ascertain site condition and the nature of soil to be excavated.

1.9 Contractor’s Staff

The Contractor must provide at all times efficient staff of trustworthy, skilful and experienced assistance capable of carrying out the work in accordance with the drawings and specification and to correct levels. The cost this establishment should be included in his rates.

1.10 Specifications Referred to:

1.10.1 The specification contained herein is not exhaustive and for such items of works which may arise and which are not covered by these specifications, the provisions in the relevant Indian Standard (Latest Edition) shall apply.

1.10.2 A list of some Indian Standards is given herein.

1.10.3 Wherever reference to the Indian Standard mentioned below or otherwise appears in the specification, it shall be taken as reference to the latest version of the Standard.

IS Code No	Description
IS: 1200	Method of measurement of building and Civil Engineering works.
IS: 1542	Sand for plaster.
IS: 383	Aggregates-Coarse and fine, from natural source for Concrete.
IS: 515	Aggregates for use in Mass Concrete, natural and manufactured.
IS: 456	Code of Practice for Plain and Reinforced Concrete for General Building construction.
IS: 3370	Code of Practice for Concrete Structures for the Storage of Liquids.
IS: 12269	Specification for 53 Grade Ordinary Portland cements.
IS: 1786	Specification for High Strength for Differed steel bar & wires for concrete reinforcement.
IS: 1077	Common Burnt Clay Building Bricks.
IS: 1235	Flooring Tiles, Cement Concrete, Floor Finish
IS: 1443	Cement Concrete, Flooring Tiles, Laying and finishing
IS: 1661	Cement and Cement Lime Pointing Plaster finishes on walls and Ceilings.
IS: 226	Structural Steel (Revised) Iron Work
IS: 800	Code of Practice for use of Structural Steel in General Building Construction

2. EARTH WORK IN EXCAVATION & FILLINGS

2.1 General

Applicable provisions of Conditions of contract shall govern work under this section.

2.2 Excavation for Foundation, Trenches, Pit etc.

2.2.1 The excavation work shall be carried out in all kinds of Soil including Sand in workman link manner without endangering the safety of the nearby Structures or works without causing any hindrance to other activities in the area. The existence of old buildings, boundary walls, hutment, sewer lines, water lines, if any very close to the area of excavation should be given careful consideration while designing carrying out the excavation work. The excavation shall be done in such method as would technically be appropriate and befitting the site conditions subject to the approval of the Engineer-in-Charge. All foundation trenches shall be excavated to the full width and depths shown on the approved drawing or to such ordered to the Contractor.

The Contractor shall not undertake any earthwork without having obtained prior approval from the Engineer-in-Charge to the methods he proposes to employ in order to execute the work in the most efficient manner. He shall not modify such methods without the approval of the Engineer-in-Charge. This approval, however, shall not in any way make the Engineer-in-Charge responsible for any consequent loss or damage.

2.2.2 Should any excavation be taken down the specified levels, the Contractor shall fill in such excavation at his own cost with concrete as specified for foundations, well rammed in position until it is brought up to the specified level.

2.2.3 The Contractor shall notify when the excavation is completed and no concrete or masonry shall be laid until the soil for each individual footing, rafts etc. is approved.

2.2.4 The Contractor shall keep the site clear of water at all times. To this end he shall provide arrangements for bailing and pumping or any special arrangements as required within his quoted prices.

2.2.5 All foundation pits shall be refilled to the finished ground level (formation level) with approved materials, which shall be suitably consolidated in layers to the satisfaction of the Engineer-in-Charge.

2.2.6 Nothing extra will be paid for bailing out water collecting in excavation due to rains, ordinary springs, leakage from any other sources etc., or any other reason.

2.2.7 For the work of excavation the Bidder shall included in his quotation the shoring, sheeting, bracing and sheet pilling (if required).

3.0 CONCRETE

3.1 General

3.1.1 Applicable provisions of Conditions of Concrete shall govern work under this section.

3.1.2 All concrete work, plain or reinforced shall be carried out strictly in accordance with this specification and any working drawing or instructions given from time to time to the Contractor.

3.1.3 The Contractor's states shall allow for wastages in all materials as well as for all tests of materials and concrete.

3.1.4 No concrete shall be cast in the absence of the Engineer-in-Charge or any other person duly authorized by him. The Contractor's Engineer shall personally check that both the form work and reinforcement have been correctly placed and fixed, and shall satisfy himself that all work preparatory to the casting is completely ready, before informing the Engineer-in-Charge for final inspection and approval and for which purpose at least 24 hours notice shall be given by the Contractor.

3.1.5 The Indian Standards wherever referred to herein shall be the latest addition of such standards.

3.2 Cement

Cement shall conform for IS: 12269; 1987 Cement tests shall have to be carried out at Contractor's expense as and when directed. Cement, which has or practically set, shall not be used under any circumstances. The important structures should be constructed with the grade of cement not below 53 (Grade-53). No extra payment will be made for using Grade-53 cement or more grades available in departmental store. In case of brand of cement contractor have to choose one brand from given brands by E.I.C in writing prior of starting work & the decision given by E.I.C regarding brand of cement is final and binding.

3.3 Reinforcement

3.3.1 The Contractor shall prepare and furnish to the Engineer-in-Charge, Bar Bending Schedules in considerations of the approved drawings for all R.C. C. works for review and checking by the Engineer-in-Charge well before taking up the work.

3.3.2 The High Yield strength deformed bars (HYSD) shall conform to IS: 1786-1990.

All steel for reinforcement shall be free from loose, oil, grease, paint or other harmful matters immediately before placing the concrete.

3.3.3 The Reinforcement shall be bent to the shapes shown on the approved drawings prior to placing and all bars must be bent cold. The Steel shall be placed in such a way that it is rigidly held in position while concrete is being cast. The correct clearance from the form shall be maintained by either pre-cast mortar blocks or by metal supporting chairs to be supplied by the Contractor free of charge.

The intersection of roads crossing one another shall be bound together with soft pliable with No. 16 to 18 SWG at every intersection so that reinforcement will not be displaced in the process of depositing concrete. The loops of binding wire should be tightened by pliers and welding of reinforcement for lapping & binding should be done if desired by E.I.C. No extra payment will be made for this purpose.

3.3.4 The work of reinforcement shall also be inclusive of stirrups distribution bars, binders, initial straightening and removing of loose rust, if necessary, cutting to requisite length, hooking and bending to correct shape, placing in proper position including supplying and binding with block annealed wire as stated in clause 3.3.3 above.

3.4.5 In case of brand of Steel contractor have to choose one brand from given brands by E.I.C in writing prior of starting work & the decision given by E.I.C regarding brand of steel is final and binding.

3.4 Water

The Water shall be clean and free from Alkali oil or injurious amounts of deleterious materials. As far as possible, the water is of such quality that it is potable. If any chemical analysis of water is necessary and ordered, the same shall be carried out at an approved laboratory at the Contractor’s cost and expenses.

3.5 Concrete Proportioning

3.5.1 The concrete proportions shall be as indicated on the approved drawings and shall conform to IS: 456 & IS: 3370. The quality and character of concrete aggregates shall be governed by IS: 383. It should be sampled and analyzed as per IS: 1199. The concrete should stand the test specified in IS: 516.

3.5.2 The minimum cover of main reinforcement shall be as per relevant IS: Codes. Cover to any reinforcement of R.C.C. piles shall be minimum 65 mm in case in-situ and 50 mm in case of pre-cast piles. Suitable spacer blocks shall be provided at intervals not exceeding 1.2 m. throughout the length of the pile.
3.5.3 The workability shall be measured by slump. Slump for different grades of concrete shall not exceed following unless specifically permitted by the Engineer-in-Charge.
i) For M 15 concrete - 3.75 cm.
ii) For M 20 concrete - 2.50 cm.
iii) For M 25 concrete – 2.00 cm
3.5.4 All concrete works shall be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures and into comers of the form work.
The Concrete shall be thoroughly and shall be efficiently vibrated during laying. The use of mechanical vibrators shall comply with IS: 2608, IS: 2506 and IS:4656. Whenever vibration has to be applied externally, the design of formwork and deposition of vibration shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.
3.5.6 Test for Water Tightness of Structures / Pipes
For liquid retaining structures including inlet chambers etc. shall be deemed to be satisfactory water tight as per relevant clause of IS: 3370. The Contractor at his own expenses, if necessary, shall undertake approved corrective measures.
As regards the pipelines, the tests shall be performed for the Hydrostatic Pressure of 10 Kg./Sq. cm in case of S.W.D., D.I. Pipes and 2 Kg./Sq. cm. for P. S. C. respectively. The tests shall be carried out as per relevant IS Codes and pipes shall be considered satisfactory if the tests results satisfy the requirements of the relevant clauses of the Codes. The Contractor shall give all these Hydraulic Tests by making his own arrangements for water supply and filling and disposing the water after the tests. The Contractor shall rectify the defects noticed and carry out the tests again and repeat the testing operation till successful result is obtained and accepted by the Engineer. The rates Quoted for the work shall be considered as inclusive of cost of all Labour, materials and equipment required to give successful tests for Water tightness.

3.6 Workmanship
3.6.1 All Concreting work shall be carried out according to the IS: 456, IS: 3370, and other related codes. It should, however, be noted that for every 15 M^3 of concrete placed or for every one day's volume of concrete whichever is lower, a minimum of 3 (three) Cubes shall be kept for test purpose, and tested at the Contractor's cost and expenses at a Laboratory as approved by the Authority. The number of test cubes may, however, be altered at discretion of the Engineer-in-Charge. It is compulsory to test 3 (three) cubes in each case.

3.6.2 Structural Concrete
Design mix Concrete shall be on all concrete works except in case of Mud-mat concrete lean concrete where nominal mix concrete will be allowed.
Concrete Works such as Reinforced Concrete Structure & Water retaining Structure shall be in Grade of M25 and design mix Concrete shall be used as accordance to the IS 456.
The mix shall be designed to produce the grade of concrete having required workability and a Characteristic Strength not less than appropriate values given in IS: 456 - 2000. For mix design, procedure given in Indian Standard recommendation or any other standard procedure shall be adopted. As long as the quality of materials does not change a mix design done earlier may be considered adequate for later work. Batching mixing, sampling and Strength Test of concrete shall be carried out in compliance with the relevant clause of IS: 456-2000 and all other relevant Indian Standards recommended therein.
The mix design by the Contractor shall be used for works only after obtaining written approval of the Engineer-in-Charge. Mix design shall be entirely the responsibility of the Contractor and any approval by the Engineer-in-Charge shall not relieve him of his responsibility in respect thereof.
The Contractor shall prepare all the Calculations. Tabulations, Graphs etc. pertaining to Mix Design Test result and supply copies of such Calculations, tabulations, Graphs etc. required by the Engineer-in-Charge.
On proportioning concrete, the quantity of both cement and aggregate shall be determined by weight, where the weight of cement is determined on the basis of weight per bag a reasonable number of bags be weighed

periodically to check the net weight or should be either weighed or measured by volume in calibrated tanks, All measuring equipments shall be maintained in a clean serviceable condition and shall periodically checked for accuracy.

The grading of coarse and fine aggregates shall be checked frequently and frequency of testing shall be determined by the Engineer-in-Charge. Where weight batching is not possible or practicable, the quantities of coarse and fine aggregates may be determined by volume but cement in any case shall be weighed by weight only. If fine aggregate and volume batching is adopted, allowance shall be made for bulking. The bulking shall be determined in accordance with IS: 2386 (Part-III).

The Water-Cement Ratio shall be maintained to its correct value. Surface moisture content of aggregate shall be determined as per IS: 2386 (Part-III) andthe amount of water to be added shall be adjusted accordingly to maintain the correct Water-cement ratio.

During the progress of work in order to ensure correct strength of concrete proper control should be exercised by the Contractor as specified in Specifications mentioned in the Clause 3.7.1 above. Test strength of every sample shall be determined in accordance with the recommendations of IS: 456-2000. If one out of ten consecutive test cubes shows a deficiency in strength up-to a maximum limit of 10%, the concrete will be deemed satisfactory. If two of the test cubes out of ten shows a deficiency in strength up to a limit of 10%, the concrete shall be deemed to be less satisfactory and a reduction of 1 % will be made on the cost of such concrete. If three out of ten test cubes show deficiency in strength up to a limit of 10%, a reduction of 5% will be made on the cost of such concrete. If more than three test cubes show a deficiency in strength up-to a limit of 10% a reduction of 10% will be made on the cost of such concrete. If more than five shows a deficiency in strength up-to a limit of 10%, the concrete shall be rejected. Such rejected concrete work shall have to be dismantled and replaced to the satisfaction of the Engineer-in-Charge by the Contractor free of cost to the Employer. No payment for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures etc. wasted in the dismantled portion, shall be made. In the course of dismantling, if any, damage is done to the embedded items or adjacent structures, the same shall also be made good free of charge by the Contractor to the satisfaction of the Engineer-in-Charge.

If the deficiency in strength of one-test cubes exceeds the 10% limit, a reduction of 5% will be made on the cost of such concrete. If the deficiency in strength to two out of ten test cubes exceeds the 10% limit, a reduction of 10% will be made on the cost of such concrete. If the deficiency in strength of three out of ten test cubes exceeds the 10% limit, a deduction of 20% on the cost of such concrete will be made.

All deduction will be made with respect to current P.W.D. schedule of rates according to the direction of E.I.C.

With permission of the Engineer-in-Charge for any above mentioned grades of concrete, if the quantity of water has to be increased in special cases, cement shall also be increased proportionally to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for additional cement will be made.

Construction Joints

These shall be in according with IS: 3370.

3.7 Expansion Joints as per IS Code relating to liquid retaining structure

Expansion joints shall be provided at position as directed and the spacing shall not exceed the limits specified in IS: 456. These shall comply strictly with the details shown on approved construction drawings. Reinforcement shall not extend across any expansion Joint and the break between the two sections must be complete.

3.8 Details of typical expansion joints and construction joints should comply with the suggestive arrangements shown in IS: 3370 (Part-I), Clause 8.1 (a)(2), Figure 2 (for expansion Joints) and Clause 8.1(a) Figure 1, Clause 8.1 (b) Figure 4 (for construction joints).

3.9 PVC Water Stops as per IS Code relating to liquid retaining structure

The materials shall be durable and tough and as per approval of the Engineer-in-Charge. The minimum thickness of PVC sealing strips shall be 6 mm. and the minimum width 225-mm actual shape and size shall be as per drawings. The materials should be of good quality polyvinyl chloride highly resistant to learning abrasion and corrosion as well as to chemicals likely to come in contact with during use. The physical properties will generally be as follows:

Specific Gravity 1.3 to 1.35
Shore Hardness 60 A to 80 A
Tensile Strength 100 to 150 Kg/Cm^2
Minimum Safe Continuous Temperature 75^0C
Ultimate Elongation Not less than 275%
Water Absorption Not more than 5% by weight in a 7 day test.

4. Contractor's Supervision

The Contractor shall provide constant and strict supervision of all the items of construction during progress of work, including the proportioning and mixing of the concrete and bending and placing of reinforcement. Any important operation such as concreting or stripping of form work adequate notice shall be given below.
The cement and sand shall be thoroughly mixed dry in specified proportions. Water shall then be added just sufficient to make a stiff and workable paste. The mortar shall be used within half an hour of mixing.
4.1 The Contractor shall build all Precast Concrete block masonry work uniformly no one portion being raised more than 1 meter above another at a time. The joints shall not exceed 12 fore executions in thickness and should extend the full thickness of the Precast Concrete block masonry work. All joints shall be properly raked and the surface washed down.

5.0 PLASTERING, PAINTING AND SURFACE TREATMENT

5.1 Cement Plaster
5.1.1 The plastering work shall be governed by IS: 1661. Unless otherwise specified cement plaster shall be composed of 1 part of cement and 6 parts of sand. For ceiling plaster, the composition shall be 1 part of cement and 4 parts of sand. The thickness of ceiling plaster shall be 6 mm. The thickness of plaster to the fair faces of Precast Concrete Block shall be 19 mm. The thickness mentioned shall be minimum thickness. The Contractor shall allow in his rate for any rubbing out due to inequalities of Precast Concrete Block.
5.1.2 The rate shall also include for forming of any moulding drip course etc., and for extra thickness due to corbelling of brick work in parapet or at any other place. If required, all internal angles shall be rounded off as per drawing or as directed by the Engineer-in-Charge without any extra charges
5.1.3 Cement and sand shall be measured and mixed dry thoroughly to a uniform colour on a platform specially constructed for the purpose. Care should be taken to see that no foreign matters get mixed with the mixture. Only enough water shall be mixed to make the mixture workable. The mix shall then be turned over and again to a uniform colour and texture number more cement mortar shall be mixed at a time than cannot be used within thirty (30) minutes of mixing.
5.1.4 Surface to be plastered are to be brushed clean, wetted for 24 hours before the plaster is put in and the joints of the Precast Concrete Block plastered work raked out 12 mm. deep minimum. The concrete faces to be plastered shall be chipped, roughened and soaked with water for achieving required bond with the plaster without any extra cost.
5.1.5 The surface of the plaster shall be finished absolutely in one plane. The Contractor shall rub down any unevenness with carborandum stones at his cost and expenses. Care shall be taken to see that no mark remains at the junction of plastering done at different times. If necessary, the junctions shall be rubbed with carborandum stones to eliminate such undesirable marks. The Contractor may be required to use normal sprinkling of thin cement slurry on the surface for satisfactory finishing of the plastering work for which no extra payment shall be made.
5.1.6 Plaster shall be protected and cured by keeping it thoroughly wet with sprinkling of water for 10 (ten) days continuously.
5.1.7 The cost of plastering work shall also include the cost of necessary scaffolding, staging etc. as would be required for the work

6.0 SURFACE FINISHING

6.1 General
The cost of all the items of work under this section should include the cost of necessary scaffolding, staging, preparing sub base, removing stains from the floor, skirting, wood work, glass etc. caused through execution of the work.

6.2 White Washing

6.2.1 White washing shall be done with 5(five) parts of stone lime and I (one) part of shell lime with necessary gum (about 2 Kg per M3 of lime) using a small quantity of blue as per direction of Engineer-in-Charge. The lime shall be brought to the site un-slaked and shall be slaked at site with an excess of water and allowed to remain under water for (two) days. To the mixture fresh water may be added to bring the consistency to that of a thin cream. When thoroughly mixed, the mix is to be strained through coarse cloth. The surface of the wall is to be brushed thoroughly cleaned before the white washing is applied. Each coat of white wash has to be laid on with brushes. Each coat of White Wash means one continuous strike of brush with the prepared wash from top downwards. Another similar strike bottom upward over first strike followed by another similar strike from right to left and another from left to right over the right application of brush before it dries. Each coat must be perfectly uniform when finished and free from brush mark etc.

6.2.2 Three coats of white wash will mean a minimum of 3 (three) coats to produce on opaque white surface to the entire satisfaction of the Engineer-in-Charge. If the surface is blotchy or otherwise unsatisfactory, number of coats shall be applied till the desired effect is produced to the satisfaction of the Engineer-in-Charge without any additional cost.

6.3 Snowcem or Similar Decorative Cement Finish

6.3.1 Where specified, external surface shall be finished with two coats of 'Snowcem' or similar decorative cement finish of approved colour, shade and manufacture. The surface to be finished it to be previously cleaned down to remove loose dust or dirt by use of stiff wire brush. All inequalities to be rubbed down and defects rectified. The surface to be wetted well with water and the surface water is to be allowed to run off. The 'Snowcem' or equivalent to be mixed will be strictly as per manufacturer's specification. The mixed 'Snowcem' or equivalent to be applied to the surface with a brush of a good quality. The first coat should be well brushed into the surface to form a good bond. Second coat should be applied carefully to give a good finished appearance may be applied by brushing or spraying. Each 'Snowcem' or equivalent application shall be wetted at the end of the day with a fine water spray.

6.4Painting to Steel Works

6.4.1 Any shop coat of paint shall not be considered as a coat of paint for the purpose of specification.

6.4.2 Ready mixed synthetic enamel paint of 'Jenson & Nicholson' 'British Paints', 'Shalimar Paints or similar other approved make and approved colour and shade shall only be used. The primer shall be red oxide zinc chromate primer (1S: 2074) or any other anticorrosive primer as approved and directed by the Engineer-in-Charge. The Contractor shall furnish the details of paints to the Engineer-in-Charge for approval of paints before commencement of painting work.

6.4.3 The surface to be painted shall be properly cleaned, de-rusted, all loose scales removed and smoothened with emery papers. Then a coat of anticorrosive priming shall be evenly applied. After this has dried up, two successive coats of best quality ready mixed synthetic enamel paint shall be given to the entire satisfaction of the Engineer-in-Charge. Brushes of approved size and make shall only be used for application of paint and use of cloth is definitely prohibited.

7.0 DAMP PROOFING WORK

7.1 Unless otherwise specified, damp proof course shall be 25-mm thick cement concrete (1:2:4) with stone chips graded 10 mm to 3 mm with 3% Cica or similar approved water proofing compound conforming of IS: 2645 by weight of cement. The proportioning, laying etc. shall be done is conformity with specification for cement concrete work. The damp proof course shall be used for all Precast Concrete Block walls of the building.

8.0 FLOORING

8.1 Patent Stone Floorings shall be 25mm. thick in M20 grade concrete with 10mm. to 6mm. stone ships laid in rectangular panel with diagonal length not exceeding 3.00M and finished smooth with neat comment punning 1.5mm thick. After finishing, the surface shall be left undisturbed for two hours and then with wet bags and after 24 hours cured by flooding with water and kept wet for at least 7 (seven) days. Required Camber or Slope should be provided in floor draining wash water, if necessary.

8.2 Cast-in-Situ Mosaic in floor shall be 25mm.thick (finished) laid in panels as directed with necessary underlay of cement concrete (1:2:4) with stone chips with 12mm. thick terrazzo topping finished to 9 mm. after final grinding with 0 to 10 mm. size Mosaic chips highly polished etc. - complete as per specification of IS;

2114-1962. Cast-in-situ Mosaic in Skirting and Dado shall be 12mm. thick. The Mosaic work shall be of approved colour and to the entire satisfaction of the Engineer-in-Charge.

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9.0 STRUCTURAL STEEL WORK

9.1 All Structural Steel to be used for gantry beam etc. shall be of tested quality conforming to IS: 226 and IS: 2062 latest addition.

Finished steel shall be free from cracks, lamination and other visible defects. Section shall be adequately protected from rusting and scaling. Rivets and bolts, nuts and washers shall be of mild steel and comply with requirements of relevant IS Codes. Steel used for rails shall have tensile strength of about 50-60 Kg/Sq. mm. and yield point at 26 Kg/Sq. mm. The electrodes for welding shall conform to IS: 8l4. All steel work shall be fabricated and erected as per IS: 800 and IS: 806. Welding shall be carried out as per IS: 8l4, IS: 815, IS: 816 and IS: 823, all of the latest editions.

9.2 All steel work, after preparation of surface, shall be given a coat of red oxide zinc chromate primer (IS: 2074) and finished with two coats of Synthetic enamel paint. Surface to be painted shall be thoroughly cleaned of mill scale, oil grease, rust etc. over coating and finishing paints shall be of well-known make (vise Jenson & Nicholson/ Berger Paints/ Shalimar Paints). The Contractor shall furnish details of Paints to the Engineer-in-Charge for approval of paints before commencement of painting work.

9.3 Steel work shall be hoisted and erected in position in a safe and proper manner. No riveting or permanent bolting shall be done until proper alignment has been made. For grouting, cement and clean fine sand shall be used in a proportion of 1:2 and properly mixed with water. All trapped pockets shall be fully vented for full penetration of grout. All grouting shall be cured for a minimum period of seven days.

10. M.S. PIPELINES

M.S. Pipe lines in required lengths and should be spirally welded from reputed manufacturers and M.S. specials will be fabricated from the said MSSW pipe or from M.S. Plates cut to exact size and shape, bent true to curvature and welded using standard electrodes after necessary edge preparations. Both the inside and outside surfaces of the MSSW pipes and specials shall thereafter be thoroughly cleaned after de-rusting and brushing. The outside surface shall then be wrapped and coated with a protective coal tar based insulating tape of 4 mm. average thickness as approved over one coat of approved primer leaving 150 mm. on either end of pipes unwrapped. The inside-surfaces will be provided with 3 (three) coats of non-toxic paint over one coat of primer.

The pipes and specials will be lowered in trenches for laying only after testing the same with spark test by holiday detector so as to ensure that the pipes and special are free of holidays. The pipes thus lowered will then be interconnected by welding and the portions of 150 mm. width left unwrapped on either side of pipes will then the wrapped with said insulating tape.

The thickness of SWMS pipes and specials of 900 mm diameter shall be 12 mm.

GUARANTEE PERIOD

The Contractor shall stand guarantee for the successful operation of the plant for 12 (Twelve) months period from the date of the certified commissioning within which any defects and short coming due to faulty design of the plant, defective mechanical and electrical equipment or defective construction will have to be made good without any extra cost to the Authority. During the guarantee period the Contractor shall ensure thorough checking of the plant at least once every month and arrange for immediate rectification of any defects detected during this special drive by his experts.

11.0 GUARANTEES

The Contractor shall give the following guarantees

11.1 Civil and Structural Works

The Contractor shall guarantee the plant against any structural failure due to faulty design, bad workmanship, substandard materials, etc. for a period of twelve months. Any defect found during the guarantee period shall be rectified by the Contractor to the satisfaction of the Engineer without any extra cost.

11.2 Equipment

Even when a plant or equipment has been manufactured and / or marketed by a vendor, it would be deemed to have been supplied and installed under the contractor's supervision. The Contractor shall provide back-to-back guarantee along with the vendor but shall solely be responsible for its repair/replacement. He shall not cite the vendor and claim absolvent. In addition, all equipment shall be free from any defects due to faulty designs, materials and / or workmanship. The equipment shall operate satisfactorily and performances and efficiencies shall not be less than the values guaranteed by the manufacturer and endorsed by the Contractor.
Formal acceptance of the work or equipment covered under the Contract by the Engineer shall not be made until all the work done by the Contractor has satisfactorily passes all tests required by the specifications.
If, during testing of work and / or equipment prior to formal acceptance, any equipment or materials shall fail in any respect to meet the guarantees, the Contractor shall replace such equipment in a condition, which will meet the guaranteed performance. Any such work shall be carried out by the Contractor at his own cost and expenses in necessity thereof, shall in the opinion of the Engineer be due to the use of materials or workmanship not in accordance with the Contract or to neglect or failure on the part of the Contractor to comply with any obligation expressed or implied on the Contractor's part under the Contract. If in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.
If the Contractor shall fail to do any such work as aforesaid, required by the Engineer, the Employer shall be entitled to carry out such work by its own workman or by others and if such work is supposed to be carried out by Contractor the cost thereof, or may deduct the same from any money due or that may become due to the Contractor.

12.0 IMPORTANT GUIDELINES AND SPECIFICATIONS

12.1 Unless otherwise specified elsewhere, the work shall be carried out as per the following specifications.
12.2 All civil works shall be carried out as per specifications contained in other section of these tender specifications.
12.3 All electrical works including supply of all electrical equipment shall be carried out as per specifications contained in other section of the tender specification.
12.4 All mechanical works including supply of equipment shall be carried out as per specifications contained in other section of these tender specifications.
12.5 The erection and commissioning works shall be carried out as per specifications contained in other section of these tender specifications.
12.6 All windows and ventilators/skylights shall be provided with Aluminium glazed panel of approved design.

TECHNICAL SPECIFICATION OF ELECTRICAL WORKS:

1.0 INTERNAL ELECTRICAL WORKS INSTALLATION & ALLIED WORKS

For Detailed Specification of DSR items of Internal Electrical works mentioned in SOQ shall be as per CPWD General specification for electrical works Part 1 (Internal) 2013 (corrected up to the last date of submission/uploading of bid).

1.0 **GENERAL**

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice. It shall also be in conformity with the current Indian Electricity rules and regulations of local Electricity Rules. Fire Insurance Rules, I.S. Codes and Indian Electricity Rules.
General Specifications for Electrical Works/Items.

- Part -I - Internal Work - 2005.
- Part -II - External Work - 2007.
- Part -IV - Substation Work - 2007.

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take precedence over the said regulations and standards.

The details of scope of work subhead wise are given in the subsequent paras. The quantities worked out in schedule of quantities are based on particular equipment considered at design stage. The contractor is required to recheck the quantities based on equipment offered by him to achieve required parameters.

TECHNICAL SPECIFICATION FOR L.T CABELS

1.0 **GENERAL**

L.T. Cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

1.1 **MATERIALS**

The L.T. Power cables shall be XLPE insulated PVC sheathed type aluminium conductor armoured cable conforming to IS : 7098 : 1988 (Part-I) with upto date amendments where as control cable shall be XLPE insulated and PVC sheathed copper conductor armoured/ unarmoured cable conforming to IS:7098 (Part-I) 1988.

1.3 **INSTALLATION OF CABLES**

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall/ceiling etc. as indicated on drawings and/or as per the direction of Engineer-in-Charge. Cable laying shall be carried out as per CPWD specifications.

1.4 **INSPECTION**

All cables shall be inspected at site and checked for any damage during transit.

1.5 **JOINTS IN CABLES**

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoiding of cable joints. This apportioning shall be got approved from Engineer-in-Charge before the cables are cut to lengths.

1.6 **LAYING CABLES IN GROUND**

Cables shall be laid by skilled experienced workmen using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care it shall be unrolled on over wooden rollers placed in trenches at intervals not exceeding 2 metres. Cables shall be laid at depth of 0.75 metres below ground level. A cushion of sand total of 250mm shall be provided both above and below the cable, joint boxes and other accessories**.** Cable shall not be laid in the same trench or alongside a water main**.**

The cable shall be laid in excavated trench over 80mm layer of sand cushion. The relative position of the cables, laid in the same trench shall preserved. At all changes in direction in horizontal and vertical planes, the cables shall be bent smooth with a radius of bent not less than 12 times the diameter of cables. Minimum 3 metre long loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases**.** Insulation tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

1.7 **PROTECTION OF CABLES**

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cable is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 80mm on either side of the cables. Cable

under road crossings and any other places subject to heavy traffic shall be protected by running them through Hume Pipes of suitable size.

1.8 **EXCAVATION & BACK FILL**

All excavation and back fill required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The Contractor shall restore all surfaces, roadways, sidewalks, kerbs wall or the works cut by excavation to their original condition to the satisfaction of the Engineer-in-Charge-In-Charge.

1.9 **LAYING OF CABLES ON CABLE TRAY/SURFACE OF WALL/CEILING**

Cable shall be laid on perforated M.S. Cable tray. Cables shall be properly dressed before cable ties/clamps are fixed. Wherever cable tray is not proposed, cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps/ saddles**.** Care shall be taken to avoid crossing of cable.

1.10 **CABLES ON HANGERS OR RACKS**

The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.
Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good.
The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 150mm centres. These shall be designed to keep provision of some spare capacity for future development.

1.11 **CABLES TAGS**

Cable tags shall be made out of 2mm thick aluminium sheets, each tag 1-1/2 inch in dia with one hole of 2.5mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 metres / at both ends only.

1.12 **TESTING OF CABLES**

Prior to installation, burying of cables, following tests shall be carried out. Insulation test between phases, phase & neutral, phase &earth for each length of cable.

a. Before laying.
b. After laying.
c. After jointing.

On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer-in-Charge-In-Charge.

a. Insulation Resistance Test (Sectional and overall).
b. Continuity Resistance Test.
c. Earth Test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules**.** The Contractor shall provide necessary instruments, equipments and labour for conducting the above tests & shall bear all expenses of conducting such tests.

TECHNICAL SPECIFICATION OF POINT WIRING

1.0 **SCOPE**

This section covers the general technical requirements and measurement of the various components in Internal Electrical Installation Works.

1.1 **TERMINOLOGY**

The definition of terms shall be accordance with IS 732: 1989 (Indian Standard Code of Practice for Electrical Wiring), except for the definitions of point, circuit and submain wiring, which are defined in Clause 1.2, 1.3 and 1.3.2 hereunder.

1.2 **POINT WIRING**

1.2.1 Definition:

A point (other than socket outlet point) shall include all works necessary in complete wiring to the following outlets from the controlling switch or MCB. The scope of wiring for a point shall, however, includes the wiring work necessary in tapping from another point in the same distribution circuit: -

a) Ceiling rose or connector (in the case of points for ceiling/ exhaust fan points, pre-wired light fittings and call bells)
b) Ceiling rose (in case of pendants except stiff pendants)
c) Back plate (in the case of stiff pendants)
d) Lamp holder (in the case of gooseneck type wall brackets, batten holders and fittings which are not pre-wired.

1.2.2 In the case of call bell points, the words "from the controlling switch or MCB" shall be read as "from the ceiling rose meant for connection to bell push".

1.2.3 Scope

i) Following shall be deemed to be included in point wiring :

a) Conduit, accessories for the conduit and wiring cables between the switch box and point outlet, loop protective earthings of each fan/ light fixture.
b) All fixing accessories such as clips, nails, screws, Phil plug, rawl plug etc. as required.
c) Metal switch boxes for control switches, regulators, sockets etc. recessed or surface type and phenolic laminated sheet covers in case of piano type switches and outer & inner cover plates in case of modular type switches.
d) Outlet boxes, junction boxes, pull-through boxes etc. but excluding metal boxes if any, provided with switchboards for loose wires/ conduit terminations.
e) Control switch or MCB as specified.
f) Ceiling rose or connector as required.
g) Connections to ceiling rose, connector, lamp holder, switch etc.
h) Interconnection wiring between points on the same circuit, in the same switch box or from another.
i) Protective (loop earthings) conductor from one metallic switch box to another in the distribution circuits, and for socket outlets. (The length of protective conductor run alongwith the circuits/ submains is excluded from the scope of points)
j) Based conduit or porcelain tubing where wiring cables pass through wall etc.

ii) Following shall be deemed to be included in group control point wiring:

Conduit, accessories for the conduit and wiring cables between the Switchboard/ MCBDB to the first point or wiring cable between points forming a group including loop protective earthings of each fan/ light fixture. (Providing MCB/Switch is not included in this scope and will be measured separately)

All fixing accessories such as clips, nails, screws, Phil plug, raw plug etc. as required.
Junction boxes, pull-through boxes etc. but excluding metal boxes if any, provided with Switchboard/ MCBDB for loose wires/ conduit terminations.

Ceiling rose or connector as required.
Connections to ceiling rose, connector & Switch/ MCB etc.
Bushed conduit or porcelain tubing where wiring cables pass through wall etc.

1.3 **MEASUREMENT**

1.3.1 POINT WIRING (OTHER THAN SOCKET OUTLET POINT)

Unless and otherwise specified, there shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting.

No separate measurement will made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes.

1.3.2 POINT WIRING FOR SOCKET OUTLET POINTS

i) The light plug (5 / 6 Amp) point and power(15 / 16 Amp) point wiring shall be measured on linear basis, from the respective tapping point of live cable, namely, switchbox, another socket outlet point, or the Sub distribution board as the case may be, upto the socket outlet.
ii) The metal box with covers, switch/ MCB, socket outlet and other accessories shall be measured and paid as separate item.
iii) The power point may be 15/5 Amp or 16/6 Amp 6 pin socket outlet, where so specified in the Tender documents. (2 pin or 5 pin socket outlet shall not be permitted.)

1.3.3 SWITCH CONTROL GROUP POINT WIRING

i) In the case of points with more than one point controlled by one switch, such points shall be measured in part i.e. from switch to the first point outlet as one point and (from switch to first point of group controlled point). Subsequent looping points i.e. one point to another point in the same group will be measured under group controlled point (from one point to another point).
ii) No recovery shall be made for non provision of more than one switch in such cases.

1.3.4 MCB CONTROL GROUP POINT WIRING

i) In the case of points with more than one point controlled by one MCB, such points shall be measured in part i.e. from MCB to the first point outlet as one point and will be measured under group controlled point (from MCB to first point of group controlled point). Subsequent looping points i.e one point to another point in the same group will be measured under group controlled point (from one point to another point).
ii) Providing MCB is not covered in this scope and will be measured separately and shall be separately paid for.

1.3.5 TWIN CONTROL LIGHT POINTS WIRING

i) A light point controlled by two numbers of two way switches shall be measured as two points from the fitting to the switches on either side.
ii) No recovery shall be made for non-provision of more than one ceiling rose or connector in such cases.

1.4 **CIRCUIT AND SUBMAIN WIRING**

1.4.1 Circuit Wiring

Circuit wiring shall mean the wiring from the distribution board upto the tapping point for the nearest first point of that distribution circuit, viz. upto the nearest first switch box.

1.4.2 Submain Wiring

Submain wiring shall mean the wiring from one Main/Distribution switchboard to another. Measurement of circuit and submain wiring.

i) Circuit and submain shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end to end of conduit exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.

ii) The length of circuit wiring with two wires shall be measured from the distribution board to the first nearest switch box in the circuit irrespective of whether the neutral conductor is take to switch box or not.

iii) When wires of different circuit are grouped in as single conduit the same shall be measured on linear basis depending on the actual numbers and sizes of wires run.

iv) When circuit wires and wires of point wiring are run in the same conduit, circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit. As far as, practicable circuit wiring and point wiring shall be drawn in different conduit.

v) Circuit wiring and submain shall not be run in the same conduit.

vi) Protective (loop earthing) conductors, which are run along the circuit wiring and the submain wiring, shall be measured on linear basis and paid for separately.

1.5 **OTHER WIRING WORKS**

i) Except as specified above for point wiring, circuit wiring and submain wiring, other types of wiring shall be measured separately on linear basis alongwith the run of wiring depending on the actual number and sizes of wires run.

1.6 **SYSTEM OF DISTRIBUTION AND WIRING**

The main distribution board and branch distribution board shall be controlled or provided with linked switch fuse unit or miniature circuit breaker (MCB) of specified rating on the phase or live conductor or combined phase and neutral control gear for incoming and outgoing as indicated in the BOQ.

Distribution of submain and circuits.

As per final approved single line diagram.

1.6.1 Balancing of Circuits

i) The balancing of circuits in three wire or poly phase installations shall be arranged before handling to the satisfaction of the Engineer-in-Charge-In-Charge.

1.6.2 Wiring System

i) Unless and otherwise specified in the tender documents, wiring shall be done only by the "Looping System". Phase of live conductors shall be looped at the switch boxes and neutral conductors at the point outlets.

ii) Lights, fans and call bell shall be wired in the 'lighting' circuits. 15/ 16 Amp socket outlets and other power outlets shall be wired in the 'Power' circuits. 5/ 6Amp socket outlets shall be wired in the 'lighting circuits'.

iii) The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.

1.6.3 Run of Wiring

The type of wiring shall be as specified in tender document, i.e. conduit.

Surface wiring shall run, as far as possible, along the walls and ceiling so as to be easily accessible for inspection.

In no case, the open wiring shall be run above the false ceiling without the approval of Engineer-in-Charge-In-Charge.

In all types of wiring, due consideration shall be given for neatness, good appearance and safety.

1.6.4 Passing through walls or floors

When wiring cables are to pass through a wall, these shall be taken through a protection (Steel/PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either end of such holes. The ends of metallic pipe shall be neatly bushed with porcelain, PVC or other approved material.

Where a wall pipe passes outside a building so as to be exposed to weather, the outer end shall be bell mouthed and turned downwards and properly bushed on the open end.

All floor openings for carrying any wiring shall be suitably sealed after installation.

1.6.5 Joints in Wiring

i) No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.
ii) There shall be no joints in the through runs of cables. If the length of final circuit or 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.
iii) Termination of multi-stranded conductors shall be done using suitable crimping type thimbles.

1.7 CONFORMITY TO IE ACT, IE RULES AND STANDARDS

i) All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 1910 and Indian Electricity Rules, 1956, amended up to date and a certificate to this effect shall be submitted by the contractor to the Owners.
ii) The works shall also conform to relevant Indian Standard Codes of Practice shall be followed.

1.8 GENERAL REQUIREMENTS OF COMPONENTS

1.8.1 Quality of Materials

All material and equipments supplied by the Contractor shall be new. They shall be of such design, size and materials as to satisfactorily function under the rated conditions of operation and to withstand the environmental conditions at site.

1.8.2 Conformity of Standards

a) All components shall conform to relevant Indian Standard Specification, wherever existing. However, for conduits, wiring cables, piano switches and socket outlets, ISI marked materials shall only be permitted.
b) The Indian Standards, including amendments or revisions thereof upto the date of tender acceptance, shall be applicable.

1.8.3 Interchangeability

Similar parts of all switches, lamp holders, distribution fuse boards, switchgears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

1.9 CABLES

1.9.1 Wiring Cables

Conductors of wiring cables (other than flexible cables) shall be of aluminium or copper, as specified.
Stranded aluminium conductor shall not be used in wiring cables upto and including 6 Sq.mm. size.
Unless and otherwise specified, copper conductor of size 1.5 Sq.mm. and above used for wiring shall be stranded.

1.9.2 Flexible Cables

i) Conductor of flexible cables shall be of copper. The minimum cross sectional area of conductor for flexible cable shall be 0.0006 Sq. inch (14/.0076" or 14/0.193 mm).
ii) Only 3 core flexible cables shall be used for connecting single-phase appliances.
iii) Unless armour, or tough rubber, or PVC sheath mechanically protects the flexible cables, these shall not be used in workshops and other places where they are liable to mechanical damage.
iv) Flexible cable connection to bell push from ceiling rose shall be taken through steel conduit/ metallic casing and capping.

1.10 **WIRING ACCESSORIES**

1.10.1 Control Switches For Points

i) Combined switch cum socket shall not be permitted.
ii) Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor, or earthed neutral conductor of the circuit.

1.10.2 Socket Outlets

i) 5/ 6Amp and 15/ 16Amp 6 Pin socket outlets shall be installed at the following positions, unless otherwise specified.
a) Kitchen/ Pantry 23 cm above working platform and away from the likely positions of stove and sink.
b) Toilets in non-residential building – 1.25 mt. above floor level.
c) At all other places – 23 cm above floor level.

1.10.3 Switch box covers

Phenolic laminated sheet of 3 mm thick of approved shade shall be used for switch box covers in case of piano type switches. For modular type switches/sockets suitable outer and inner cover plates as specified shall be provided over the standard box as recommended by the manufacturers of modular type switch/ sockets and no separate sheet cover is required to be provided.

1.10.4 Ceiling Rose

i) A ceiling rose shall not be used on circuit the voltage of which normally exceeds 250 Volts.
ii) Only one flexible cord shall be connected to ceiling rose. Specially designed ceiling roses shall be used for multiple pendants.
iii) A ceiling rose shall not embody fuse terminal as an integral part of it.

1.11 **FITTINGS**

The type of fittings shall be as specified in BOQ of tender documents.

1.11.1 Indoor Type Fittings

i) The contractors shall supply the specified model and make of the fittings. The standard constructional features of specified make and model as given in the tender document are acceptable.
ii) Where conductors are required to be drawn through tube or channel leading to the fitting, the tube or channel must be free from sharp angles or projection edge, and of such size as will enable them to be wired with the conductors used for the final circuit without removing the braiding or sheathing. A far as possible all such tubes or channels should be of sufficient size to permit looping back.
iii) Pendants in verandas and similar situations exposed to wind shall be of fixed rod type.

iv) Fittings using discharge lamps shall be complete with power factor correction capacitors, either integrally or externally. An earth terminal with suitable marking shall be provided for each fitting for discharge lamps.

v) Fittings shall be installed such that the lamp is at a height specified in approved drawings or as directed by the Engineer-in-Charge.

1.12 ATTACHMENT OF FITTINGS AND ACCESSORIES

1.12.1 Conduiting Wiring System

i) All accessories like switches, socket outlets, call bell pushed and regulators shall be fixed in flush pattern inside the switch/ regulator boxes. Accessories like ceiling roses, brackets, batten holders; stiff pendants etc. shall be fixed on metal outlet boxes.

ii) Brass screws shall be used to fix the accessories to their bases.

iii) The switch box/ regulator box shall normally be mounted with their bottom 1.25 m from floor level, unless otherwise directed by the Engineer-in-Charge.

1.12.2 Fixing of Walls and Ceiling

i) PVC sleeves/ dash fasteners should normally be used for fixing to walls or ceiling.

ii) Plugging of walls or ceiling can be done in a better way where neatness is the first consideration. In all such cases, an approved type of asbestos or fibre fixing plug (rawl or Phil plug) with correct size of tools shall be used and done in a workmanlike manner.

1.12.3 FANS, REGULATORS AND CLAMPS

1.12.3.1 Ceiling Fans

i) Ceiling fans including their suspension shall conform to relevant Indian Standards.

ii) Any additional hardware items required for installation of ceiling fans including fan hooks/ clamps as specified below, shall be provided as specified in BOQ as a separate item.

iii) All ceiling fans shall be wired to ceiling roses or to special connector boxes, and suspended from hooks or shackles, with insulators between hooks and suspension rods. There shall be no joint in the suspension rod.

iv) For wooden or steel joists and beams, the suspension shall consist of MS flat of size not less than 40mm x 6mm, secured on the sides of the joists or beams by means of two coach screws of size not less than 5 cm for each flat. Where there is space above the beam, a through bolt of size not less than 1.5cm dia shall be placed above the beam from which the flats are suspended. In the latter case, the flats shall be secured from movements by means of another bolt and nut at the bottom of the beam. A hook consisting of MS rod of size not less than 1.5 cm dia shall be inserted between the MS flat through oval holes on their sides. Alternatively, the flats may be bent inwards to hold tightly between them by means of a bolt and nut, a hook of 'S' form.

v) In the case of 'I' beams, flats shall be shaped suitably to catch the flanges and shall be held together by means of a long bolt and nut.

vi) For concrete roofs, a 12mm dia. MS rod in the shape of 'U' with their vertical legs bent horizontally at the top at least 19cm on either side and bound to the top reinforcement of the roof shall be used.

vii) In buildings with concrete roofs having a low ceiling height, where the fan clamp mentioned under sub clause (vi) above cannot be used, or wherever specified, recessed type fan clamp inside a metallic box shall be used. The metallic box shall suitably be covered with 3mm thick phenolic laminated sheet.

viii) Canopies on top of suspension rod shall effectively hide the suspension.

ix) The leading in wire shall be of copper and nominal cross sectional area not less than 1.5 Sq.mm. and shall be protected from abrasion.

x) All ceiling fans shall be hung at a height as directed by the Engineer-in-Charge-In-Charge.

xi) In the case of measurement of extra down rod for ceiling fan including wiring, the same shall be measured in units of 10 cm. Any length less than 5cm shall be ignored.

xii) The wiring of extra down rod shall be paid as supplying and drawing cable in existing conduit.

1.12.3.2 Exhaust Fans

i) Exhaust fans shall conform to relevant Indian Standards.

ii) Exhaust fans shall be erected at the places indicated by the Engineer-in-Charge-In-Charge additional hardware items required for installation of ceiling fans including fan hooks/ clamps as specified below, shall be provided as specified in BOQ as a separate item.

1.12.3.3 Regulators

The metallic body of regulators of ceiling fans / exhaust fans shall be connected to earth by protective conductor.

1.12.3.4 Workmanship

Good workmanship is an essential requirement to be complied with. The entire work of manufacture/ fabrication, assembly and installation shall conform to sound Engineering practice.

The work shall be carried out under the direct supervision of an Engineer-in-Charge, employed by the contractor, who shall rectify then and there the defects pointed out by the Engineer-in-Charge-In-Charge during the progress of work. The qualification of Engineer-in-Charge or supervisor for over all supervision and to take instructions from the Engineer-in-Charge-In-Charge shall be as specified in the special conditions.

1.13 **TESTING OF INSTALLATION**

All the completed installations shall be tested as per specification for "Testing of Installation".

1.14 **COMMISSIONING OF COMPLETION**

1.14.1 Before the workman leaves the work finally, he must make sure that the installation is commissioned, after due testing.

1.14.2 Completion Plan and Completion Certificate

i) For all E&M items, completion certificate after completion of work as required by NHIDCL/Employer shall be submitted to the Engineer-in-Charge.

ii) Completion plan drawn to a suitable scale in tracing sheet with three blue print copies of the same shall also be submitted.

a) General Layout of the building.

b) Locations of main switchboard and distribution boards.

c) Position of all points and their controls indicating the circuit numbers controlled by them.

d) Types of fittings, viz. C.F.L., L.E.D. bracket fans, Exhaust fans etc.

e) Name of work, job number, accepted tender reference, actual date of completion, name of Engineer-in-Charge, and name of the firm who executed the work with their signature.

NON-METALLIC CONDUIT WIRING SYSTEM

1.0 **SCOPE**

This section covers the detailed requirements for wiring work in non metallic conduits. This section covers both surface and recessed types of works.

1.1 **APPLICATIONS**

Conduit system used shall be Rigid.

Flexible conduits may only be permitted for interconnections between switchgear & DBs and conduit terminations in wall.

1.2 **MATERIALS**

1.2.1 Conduits:

i) All rigid conduit pipes shall be of Heavy grade F.R.L.S. PVC. The wall thickness shall be 1.6mm (16 SWG) for conduits upto 32mm dia. and 2mm (14 SWG) for conduits above 32mm dia and as per IS. These shall be solid drawn or reamed by welding, and finished with galvanized or stove enamelled surface.

ii) The maximum number of PVC insulated cables conforming to IS: 694-1990 that can be drawn in one conduit is given size wise in Table-I, and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.

iii) No conduits less than 20mm in diameter shall be used.

1.2.2 Conduits Accessories:

i) The conduit wiring system shall be complete in all respects, including their accessories.

ii) All conduit accessories shall be of slip joint type, and under no circumstances pin grip type or clamp grip accessories shall be used.

iii) Bends, couplers etc. shall be solid type in recessed type of works and may be solid or inspection type as required, in surface type of works.

iv) a) Saddles for surface conduit work on wall shall not be less than 0.55mm (24 gauge) for conduits upto 25mm dia and not less than 0.9mm (20 gauge) for larger diameter. The corresponding widths shall be 19mm and 25mm.

b) The minimum width and the thickness of girder clips used for fixing conduits to steel joints, and clamps shall be as per Table-II.

1.2.3 Outlets:

i) The switch box regulator box shall be made of metal on all sides, except on the front. In case of welded mild steel sheet boxes the wall thickness shall not be less than 1.2mm (18 gauge) for boxes upto a size of 20 cm x 30 cm and above this size 1.6mm (16 gauge) thick MS boxes shall be used. The metallic boxes shall be duly painted with anticorrosive paint before erection as per painting specification.

ii) a) Outlet boxes for light/ power sockets shall be of standard size of manufacturer to accommodate required number of modular switches, socket outlet.

b) Where a large number of control switches and/ or fan regulators are required to be installed at one place, these shall be installed in more than one outlet box adjacent to each other for ease of maintenance.

iii) An earth terminal with stud and metal washers shall be provided in each DB/MS box for termination of protective conductor and for connection to socket outlet/ metallic body of fan regulator etc.

iv) A metal strip shall be welded/ screwed, to the metal box as support if fan regulators are to be fixed herein.

v) Clear depth of the box shall not be less than 50mm, and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.

vi) The fan regulators can also be mounted on the switch box covers, if so directed by the Engineer-in-Charge-In-Charge.

vii) The size of the switchbox in case of piano type switches shall be as below

a) Without any fan regulator/ Dimmer on the Switch box:- The size of the switch box shall be minimum 75mm x 75mm x 60mm deep to accommodate the number of switches meeting spacing requirements mentioned below.

b) With electronic/ resistance type fan regulator on the Switch box:- The size of the switch box shall be minimum 75mm x 75mm x 60mm to accommodate the number of switches and fan regulators meeting spacing requirements mentioned below.

Spacing Requirements:

The spacing between any edge of live terminal of Switch/ socket and the body shall not be less than 26mm at any point.

viii) The size of the switch box in case of modular type switches shall be as per manufacturer's standard.

1.3 **INSTALLATION**

1.3.1 Common aspects for recessed and surface conduit works.

i) Conduit Joints

a) The conduit work in each circuit or section shall be completed before the cables are drawn in.
b) Conduit pipes shall be joined by means of slip joints and using proper adhesive
c) Cut ends of conduit pipes shall have neither sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.
d) The Engineer-in-Charge-In-Charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc. after they have been prepared shall be submitted for inspection before being fixed.

ii) Bends in Conduit

a) All necessary bends in the system, including diversion, shall be done either by neatly bending the pipes without cracking with bending radius of not less than 7.5 cm., or alternatively, by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.
b) No length of conduit shall have more than the equivalent of four quarter bends from outlet to outlet.
c) Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used.

iii) Outlets

a) All outlets such as switches, wall sockets etc. may be either flush mounting type, or of surface mounting type, as specified in the additional specifications if any or as directed by the Engineer-in-Charge-In-Charge.
b) All piano type switches and accessories shall be fixed on the phenolic laminated sheet covers in flush pattern.

iv) Fixing Conduit on Surface

Conduit pipes shall be fixed by saddles, secured to suitable approved plugs with screws in an approved manner at an interval of not more than one metre, but on either side of the couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm from the centre of such fittings.
Where conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips or clamps as required by the Engineer-in-Charge-In-Charge.
In long distance straight run of conduit, inspected type couplers at reasonable intervals shall be provided, or running threads with couplers and jam nuts shall be provided.

v) Fixing 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.

1.3.3 Additional requirements for recessed conduit works

i) Making Chase

a) The chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.
b) In the case of building under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.
c) In chase of exposed brick/ rubber masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii) Fixing Conduits in Chase

a) The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddles, not more than 60 cm apart, or by any other approved means of fixing.
b) All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against trust.

iii) Fixing Conduits in RCC work

a) 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 firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

a) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with all long radius, which all permit easy drawing in of conductors.

iv) Fixing Inspection Boxes

Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary. The distance between inspection/ junction boxes shall not exceed 12.5 mts in straight run.

Location of inspection/ junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

These shall be mounted flush with the wall or ceiling concrete. Minimum 65mm depth junction boxes shall be used in roof slabs and the depth of the boxes in other places shall be as per IS : 2667-1977.
Suitable phenolic laminated sheet cover shall be provided on the inspection box.
Suitable ventilating holes shall be provided in the inspection box covers.

v) Fixing Switch Boxes and Accessories

Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified.

vi) Fish wire

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.6mm / 1.2mm (16/ 18 SWG) shall be provided alongwith the laying of the recessed conduit.

vii) Bunching of Cables

a) Cables carrying direct current may, if desired, be bunched whatever their polarity, but cables carrying alternating current, if installed in metal conduit shall always be bunched so that the outgoing and return cables are drawn into the same conduit.
b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points or outlets as the case may be.

1.3.4 Earthing Requirements

i) The entire system including the outlet boxes and other metallic accessories shall be mechanically and electrically continuous by proper screwed joints, or by double check nuts at termination. The conduit shall be continuous when passing through wall or floors.

ii) Protective (loop earthing) conductor (s) shall be laid along the runs of the conduit between the metallic switch boxes and the distribution boards/ switchboards, terminated thereto. The conductors shall be of such size and material as specified. Depending upon their size and material, the protective earth conductors shall be either drawn inside the conduits alongwith the cables, or shall be laid drawn in outside the conduits. When laid external to the conduits, this shall be properly clamped with the conduit at regular intervals.

iii) The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.

iv) Gas or water pipe shall not be used as protective conductor (earth medium).

TABLE - I

Maximum number of PVC insulated 1100 V grade aluminium/copper conductor cable conforming to IS : 694 - 1990

Nominal Cross-Sectional area of conductor in sq.mm	20mm		25mm		32mm		38mm		51mm		64mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

NOTE:

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
3. Conduit sizes are the nominal external diameters.

TABLE - II

Girder clips or clamps

Size of Conduit		Width	Thickness
i)	20 mm - - - -	19 mm	0.9mm (20 SWG)
ii)	25 mm - - - -	19 mm	0.9mm (20 SWG)
iii)	32 mm & above - - - -	25 mm	1.2mm (18 SWG)

1.4 **SPECIFICATION FOR PAINTING**

1.4.1 **SCOPE**

This section covers the requirements of painting work in internal electrical installations, carried out manually by brush. This does not cover spray painting work of factory made items.

1.4.2 **PAIINTING WORK IN GENERAL**

1.4.2.1 PAINTS

Paints, oils, vanishes etc. of approved make, in original tin to the satisfaction of the Engineer-in-Charge-In-Charge shall only be use.

1.4.2.2 PREPRATION OF THE SURFACE

The surface shall be thoroughly cleaned and made free from dust or foreign matter before painting is started. The proposed surface may be inspected by the Engineer-in-Charge-In-Charge before the paint is applied.

1.4.2.3 APPLICATION:

i) Paint shall be applied with brush. The paint shall be spread as smooth and even as possible. Particular care shall be paid to rivets, nuts, bolts and over-lapping. Before drawing out in small containers, it shall be continuously stirred with a smooth stick, while painting work is taken up.

ii) Primary coat of anti-corrosive paint shall be given in the case of steel work, after preparation the surface. In all cases of painting work, finishing shall be with 2 coats of paint in approved shade.

iii) Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.

1.4.2.4 PRECAUTIONS

All furniture, fixture, glazing, floors etc. shall be protected by suitable covering. Al stains, smears splashing, dropping etc. shall be removed. While painting of wiring etc. it shall be ensured that the painting of wall and ceiling etc. is not spoiled in any way.

TESTING OF INSTALLATION

1.0 **SCOPE**

This section describes the details of test to be conducted in the completed internal electrical installation, before commissioning.

1.1 **GENERAL**:

1.1.1 TESTS

On completion of installation, the following tests shall be carried out:-

i) Insulation resistance test.

ii) Polarity test of switch.
iii) Earth continuity test.
iv) Earth electrode resistance test.

1.1.2 WITNESSING OF TESTS

Testing shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer-in-Charge-In-Charge by the Contractor. All test results shall be recorded and submitted to the Department.

2.0 **INSULATION RESISTANCE**

The tests described below shall be made before the installation is permanently connected to the supply. For these tests large installations may be divided into groups of outlets, each containing not less than 50 outlets. For the purposes of this code the term 'outlet' includes every point and every switch except that a socket outlet, appliance or luminaire incorporating a switch is regarded as one outlet. The test voltage for insulation resistance measurement shall be 1000 V.

When measured with all fuse links in place, all switches (including, if practicable, the main switch) closed and, all poles or phases of the wiring electrically connected together, the insulation resistance to earth shall be not less than 1 mega ohm.

When measured between all the conductors connected to any one phase or pole of the supply and, in turn, all conductors connected to each other phase or pole the insulation resistance shall be not less than 1 mega ohm. Wherever practicable, so that all parts of the wiring may be tested, all lamps shall be removed and all current-using equipment shall be disconnected and all local switches controlling such lamps or other equipment shall be closed. Where the removal of lamps and/or the disconnection of current-using equipment is impracticable, the local switches controlling such lamps and/or equipment shall be open. Particular attention shall be given to the presence of electronic devices connected in the installation and such devices shall be isolated so that the test voltage does not damage them.

Where equipment is disconnected for the tests prescribed above, and the equipment has exposed conductive parts required by these clauses to be connected to protective conductors, the insulation resistance between the exposed conductive parts and all live parts of the equipment shall be measured separately and shall comply with requirements of the appropriate Indian Standard and the insulation resistance shall not less than 0.5 mega ohm.

3.0 **POLARITY TEST OF SWITCH**

In a two wire installation, a test shall be made to verify that all the switches in every circuit have been fitted in the same conductor, throughout, and such conductor, shall be labelled or marked for connection to the phase conductor, or to the non-earthed conductors of the supply.

In a three wire or a four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labelled, or marked for connection to one of the phase conductors of the supply.

The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to earth. Glowing of test lamp to its full brilliance, when the switch is in 'ON' position irrespective of appliance in position or not, shall indicate that the switch is connected to the right polarity.

4.0 **TESTING OF EARTH CONTINUITY PATH**

The earth continuity conductor, including metal conduits and metallic envelops of cables in all cases, shall be tested for electric continuity. The electrical resistance of the same alongwith the

earthing lead, but excluding any added resistance, or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

5.0 **MEASUREMENT OF EARTH ELECTRODE RESISTANCE**

5.1 Two auxiliary earth electrodes, besides the test electrode, are placed at suitable distance from the test electrode. A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C' and the potential difference between the electrode 'A' and auxiliary potential 'B' is measured. The resistance of the test electrode 'a' is then given by

R = V/I

Where,

R- Resistance of the test electrode in ohms

V- Reading of the voltmeter in volts

I- Reading of the ammeter in amps

5.1.1 i) Stray currents flowing in the soil may produce serious errors in the measurement of earth resistance. To eliminate this, hand driven generator is used.

ii) If the frequency of the supply of hand driven generator coincides with the frequency of stray current, there will be wandering of instrument pointer. An increase or decrease of generator speed will cause this to disappear.

5.1.2 At the time of test, the test electrode shall be separated from the earthing system.

5.1.3 The auxiliary electrodes shall be of 13mm diameter mild steel rod driven upto 1 m into the ground.

5.1.4 All the three electrodes shall be so placed that they are independent of the resistance area of each other. If the test electrode is in the form of a rod, pipe or plate, the auxiliary current electrode C shall be placed at least 30 m away from it and the auxiliary potential electrode 'B' shall be placed mid-way between them.

5.1.5 Unless three consecutive readings of test electrode resistance agree, the test shall be repeated by increasing the distance between electrodes A and C upto 50 m, and each time placing the electrode B mid-way between them.

5.1.6 On these principles, "Megger Earth Tester" containing a direct reading ohm-meter, a hand driven generator and auxiliary electrodes are manufactured for direct reading of earth resistance of electrodes.

6.0 **TEST CERTIFICATE**

On completion of an electrical installation or an extension to an installation, a certificate shall be furnished by the Contractor, countersigned by the competent Engineer-in-Charge PMC Rep.

FORM OF COMPLETION CERTIFICATE

I/We certify that the installation detailed below has been installed by me/us and tested and that best of my/ our knowledge and belief it complies with Indian Electricity Rules 1956, as well as the Contract Specifications.

Electrical Installation at _____

Voltage and system of supply _____

EXTERNAL ELECTRICAL WORKS

For Detailed Specification of D.G. Set of Electrical works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD General Specification for electrical works Part VII (D.G SET) 2013. (corrected up to the last date of submission/uploading of bid).

For Detailed Specification of Substation of Electrical works (Based on DSR 2018) mentioned in SOQ shall be as per CPWD General Specification for electrical works Part IV (SUBSTATION) 2013. (corrected up to the last date of submission/uploading of bid).

TECHNICAL SPECIFICATION OF LANDSCAPE WORK:

1.0 LANDSCAPE WORK:

Landscaping (Horticulture) operations shall be started on ground previously levelled and dressed to required formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or, replaced or it shall be covered over to a thickness decided by the Engineer-in-Charge with good earth. In the course of excavation or trenching during horticultural operations, any walls, foundations, etc. met with shall not be dismantled without pre-measurement and prior to the written permission of the Engineer-in-Charge.

2.0 TRENCHING IN ORDINARY SOIL:

2.1 TRENCHING

Trenching is done in order to loosen the soil, turn over the top layer containing weeds etc. and to bring up the lower layer of good earth to form a proper medium for grassing, re-grassing, hedging and shrubbery. Trenching shall be done to the depth ordered by the Engineer-in-Charge. The depth is generally 30 cm for grassing and 60 cm for re-grassing in good soil.

2.1.1 The trenched ground shall, after rough dress, be flooded with water by making small kiaries to enable the soil to settle down. Any local depression unevenness etc. shall be made good by dressing and/or filling with good soil.

2.1.2 Weeds or other vegetation which appear on the ground are then uprooted and removed and disposed off and paid.

1.1.3 Trenching shall consist of the following operations: 1. The whole plot shall be divided into narrow rectangular strips of about 1.5 m width or as directed by the Engineer-in-Charge-in-Charge. 2. These strips shall be sub-divided lengthwise into about 1 m long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it. 3. In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus. 4. The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.

2.2GOOD EARTH

2.2.1 The earth shall be stacked at site in stacks not less than 50 cm high and of volume not less than 3.0 cum.

2.3 SUPPLY AND STACKING OF SLUDGE

2.3.1 It shall be transported to the site in lorries with efficient arrangement to prevent spilling en-route. It shall be stacked at site. Each stack shall not be less than 50 cm height and volume not less than 3 cum.

2.4DIGGING HOLES FOR PLANTING TREES

2.4.1 In ordinary soil, including refilling earth after mixing with oil cake, manure and watering.

2.4.1.1 Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavate soil broken to clods of size not exceeding 75 mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the size as directed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required to replace such discarded stuff shall be brought and stacked at site by the contractor which shall be paid for separately. The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6 mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level or as directed by the Engineer-in-Charge.

3.0 SPECIFICATIONS OF PLANTS (Plants, Trees Shrubs taken in SOQ):

3.1 The plants, Trees and shrubs should be as per following specification.

1. The plants should be full of fresh and healthy foliage and importantly shall be suitable to the extreme climatic conditions of Leh.
2. The plants should be free from insect, pest and disease.
3. Plant should be healthy and vigorous growth.
4. The height of the plants will be measured from top of the pots.
5. The plants should be well settled and should not be newly shifted.
6. The plants should be true to the variety and named Variety should be tagged.
7. Moss stick used should be made on plastic pipe.
8. Moss stick should be straight and properly fixed in the pot.
9. The rejected plants materials should be removed from the site immediately.
10. Moss stick should be covered with the plants in case of plants supplied with moss stick.
11. The Plant should be well stabilised and good spread.
12. Good earth and manure used for filling the pot/poly bag free from any inert material and mixed to proper ratio.
13. Pot/ Poly bag used for filling the plants should be proper size good quality not damaged.
14. There should be proper drainage in pots for plants.
15. The flowering plants should also have proper flowering and should be true to the variety.
16. All plant should have the tendency of growth and should not be stunted type. There should be no stagnation of water in the pots.

SECTION-XI

PARTICULAR SPECIFICATIONS

PARTICULAR SPECIFICATIONS

PHE (PLUMBING WORKS)

SECTION I: GENERAL INSTRUCTIONS

1.0 **GENERAL REQUIREMENTS**

1.1 **Scope of Work**

1.1.1 The following clauses shall be considered as an extension and not in limitation of the obligation of the Contractor.

1.1.2 Work under this contract shall consist of furnishing all labour, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the Plumbing and other specialized services as described hereinafter and as specified in the Schedule of Quantities and/or shown on the Plumbing Tender Drawings.

1.1.3 Without restricting to the generally of the foregoing, the sanitary installations shall include the following:-

A. Plumbing Works

i) Sanitary Fixtures
ii) Soil, Waste & Vent and Rain Water Pipes and fittings.
iii) Water Supply System (Cold & Hot).
iv) Sewerage & Storm water drainage system
v) Pumping system & water Treatment Plant
vi) Solar hot water with heat pump backup system

1.1.4 Services rendered under this section shall be done without any extra charge.

1.2 **Specifications**

1.2.1 Work under this contract shall be carried out strictly in accordance with Technical Specifications specified in the tender.

1.2.2 Items not covered under these Specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per Technical Specifications of latest Central Public Works Department with upto date amendments as applicable in the contract and or as per the requirement of the NHIDCL or its representative.

1.2.3 Works not covered above in para 1.2.1 and 1.2.2 shall be carried out as per relevant Indian Standards and in case of its absence as per British Standard Code of Practice.

1.3. **Execution of Work**

1.3.1 The Bidder should the visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description will be allowed.

1.3.2 The work shall be carried out in conformity with the Plumbing drawings and within the requirements of Architectural, HVAC, Electrical, Structural and Other specialized services drawings.

1.3.3 The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule.

1.3.4 On award of the work, Contractor shall submit a schedule of construction in the form of a PERT Chart or BAR Chart for approval of the NHIDCL. All dates and time schedule agreed upon should be strictly adhered to, within the stipulated time of completion/commissioning along with the specified phasing, if any.

1.4 **Drawings**

1.4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the Architectural and other services drawings.

1.4.2 Architectural drawings shall take precedence over Plumbing or other services drawings as to all dimensions.

1.4.3 Contractor shall verify all dimensions at site and bring to the notice of the Engineer-in-Charge all discrepancies or deviations noticed. Decision of the Engineer-in-Charge shall be final.

1.4.4 Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.

1.4.5 All approved drawings for the work are the property of the NHIDCL and Contractor shall not be lent, reproduced or used on any works other than intended without the written permission of the NHIDCL.

1.5 **Inspection and Testing of Materials**

1.5.1 Contractor shall be required, if requested, to produce manufacturers Test Certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian Standards.

1.5.2 For examination and testing of materials and works at the site Contractor shall provide all Testing and Gauging Equipment necessary but not limited to the followings:-

a) Theodolite, Steel tapes
b) Dumpy level
c) Weighing machine
d) Plumb bobs, Spirit levels, Hammers
e) Micrometers, Tachometers
f) Thermometers, Stoves
g) Hydraulic test machine
h) Smoke test machine

1.5.3 All such equipment shall be tested for calibration at any approved laboratory, if required by the Engineer-in-Charge.

1.5.4 All Testing Equipment shall be preferably located in a special room meant for the purpose.

1.5.5 Samples of all materials shall be got approved before placing order and the approved samples shall be kept at site in the sample room at site. Any materials declared defective by Engineer-in-Charge shall be removed from the site within 48 hours.

1.6 **Metric Conversion**

1.6.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

1.6.2 Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

1.7 **Reference Points**

1.7.1 Contractor shall provide permanent Bench Marks, Flag Tops and other reference points for the proper execution of work and these shall be preserved till the end of the work.

1.7.2 All such reference points shall be in relation to the levels and locations given in the Architectural and Plumbing drawings.

1.8 **Reference Drawings**

1.8.1 The Contractor shall maintain one set of all approved drawings issued to him as reference drawings. These shall not be used on site. All important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.

1.8.2 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. All changes to be made shall be initialed by the Engineer-in-Charge.

1.9 **Shop Drawings**

1.9.1 The Contractor shall submit to the Engineer-in-Charge three copies of the shop drawings.

1.9.2 Shop drawings shall be submitted under following conditions:-

(a) Showing any changes in layout in the plumbing drawings.
(b) Equipment layout, piping and wiring diagram.
(c) Manufacturer's or Contractor's fabrication drawings for any materials or equipment supplied by him.

1.9.3 The Contractor shall submit two copies of catalogues, manufacturer's drawings, equipment characteristics data or performance charts as required by the Project Manager.

1.10 **Completion Drawings**

1.10.1 On completion of work, Contractor shall submit one complete set of original tracings and two prints of "as built" drawings to the Engineer-in-Charge. These drawings shall have the following information.

a) Run of all piping, diameters on all floors, vertical stacks and location of external services.
b) Ground and invert levels of all drainage pipes together with location of all manholes and connections upto outfall
c) Run of all water supply lines with diameters, locations of control valves, access panels.
d) Location of all mechanical equipment with layout and piping connections.

No completion certificate shall be issued unless the above drawings are submitted.

1.10.2 Contractor shall provide two sets of catalogues, service manuals manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

1.10.3 All "Warranty Cards" given by the manufacturers shall be handed over to the Project Manager.

1.11. **Contractors Rates**

1.11.1 Rates quoted in this tender shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

1.11.2 Rates quoted are for all heights and depths and in all positions as may be required for this work.

1.11.3 All rates quoted must be for complete items inclusive of all such accessories, Fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specially mentioned otherwise.

1.11.4 All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/concrete/water proofing of appropriate mix and strength as directed by Engineer-in-Charge. Contractor shall provide holes, sleeves and recesses in the concrete and masonry work as the work proceeds.

1.12 **Testing**

1.12.1 Piping and drainage works shall be tested as specified under the relevant clause(s) of the specifications.

1.12.2 Tests shall be performed in the presence of the Engineer-in-Charge.

1.12.3 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

1.12.4 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other bye-laws in force.

1.12.5 Contractor shall provide all labour, equipment and materials for the performance of the tests.

1.13 **Site Clearance and Clean-up**

1.13.1 The Contractor shall, from time to time clear away all debris and excess materials accumulated at the site.

1.13.2 After the Fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition.

1.13.3 On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at Contractors risk and cost.

1.14 **License Permits and Authorities**

1.14.1 Contractor must keep constant liaison with the Municipal/statutory authority and obtain all approval of all drainage, water supply and other works carried out by him.

1.14.2 Contractor shall obtain, from the Municipal and other authority's necessary completion certificate(s) with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. NHIDCL/Employer shall pay all fees/deposits as required to be paid to the authorities towards connection charges.

1.15 **Cutting of Water Proofing Membrane**

No walls, terraces shall be cut for making and opening after water proofing has been done without written approval of Engineer-in-Charge. Cutting of water proofing membrane shall be done very carefully to ensure that other portion(s) of water proofing is (are) not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by Engineer-in-Charge.

1.16 **Cutting of Structural Members**

No structural member shall be chased or cut without the written permission of the Engineer-in-Charge.

1.17 **Material**

a) Unless otherwise specified and expressly approved in writing by the Engineer-in-Charge, only materials of makes and specifications mentioned in the list of approved makes attached with the Tender shall be used.

b) If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Engineer-in-Charge and returned to the Contractor at the appropriate time.

SECTION II: SANITARY FIXTURES
Soils, Waste, Vent Pipes & Fittings

1 Scope of work

1.1 Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rain water pipes and fittings as required by the drawings and as given in the Schedule of Quantities.

1.2 Without restricting to the generality of the foregoing, the work shall include the following:-

a) Vertical and horizontal soil, waste, vent, and fittings, joints, clamps and connections to fixtures.
b) Soil & waste pipes to external sewers line.
c) Connection of all pipes to sewer lines as shown on the drawings at the ground floor.
d) Floor and urinal traps, cleanout plugs, inlet fittings.
e) Testing of all pipe lines.

2 General requirements

2.1 All materials shall be new and best quality conforming to Latest IS Code and specifications and subject to the approval of the Project Manager /Architect.

2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

2.4 Pipes shall be securely fixed to walls and ceilings by suitable clamps an interval specified.

2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

3 Piping System

3.1 Soil, Waste & Vent Pipes

a) The Soil & Waste pipe system above ground has been planned as a "two pipe system" as defined in IS: 5329, having separate pipes for waste from kitchen sinks, bath tubs, showers, washbasins, AHU's condensate drains and floor drains and is approved by the local authority. Waste stacks have been provided with a “P” trap at basement ceiling.

b) Vertical soil & waste stacks shall be connected to a common horizontal drain pipe at basement floor ceiling as shown on the drawings.

c) All Floors of toilets, kitchens and other service areas located on structural slab are SUNK by 300 mm to accommodate all soil & waste pipes.

d) All soil and waste from areas below general ground level will be collected in sumps and pumped into sewer lines.

e) Anti-siphonage pipe (ASP) shall be provided for soil fittings on vertical stacks. It may also be provided for waste lines where shown on the drawings.

3.4.1 Soil & Waste Pipes

3.4.2 All pipes shall be straight and smooth and inside free from cracks and other manufacturing defects. Pipes shall be noise insulated Polypropylene piping system as per DIN EN 12056 and DIN1986-100 with 3 layer pipe made of External layer -PP, middle layer-Mineral reinforced PP, Internal layer-PP. push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 10 dBA as per DIN 4109 at a flow rate of 2 l/s and having pipe ring stiffness as per 1S0/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density of pipe = 1.9 g/cm3, elongation break 50% and tensile strength 20 N/mm2,Coefficient of linear expansion 0.09 mm/mK.

3.5. Fittings

3.5.1 Fittings shall conform to the Indian Standard recommended for the pipes. Pipes and fittings must be of matching as per manufacturer specification. Interchange of pipes of one standard with fittings on the other standard will not be permitted.

3.5.2 Fittings shall be of the required degree of curvature with or without access door.

3.5.3 Connection from a vertical stack or position to a horizontal line shall be made only by a “Y” junction.

3.6 Fixing

3.6.1 All vertical pipes shall be fixed truly vertical to walls with approved type of GI clamp. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard). However shaft where more vertical pipes run, the pipes may be fixed to the slotted angle/channel supports fixed to walls at intervals specified here under:-

3.6.2 Horizontal pipes running on the floor shall be covered with cement concrete grade M-10, 75mm thick in bed and 75mm thick all around soil and waste pipes under floor

3.6.3 Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the Project Manager/Building Contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces at no extra cost.

4.0 Clamps

4.1 Holder bat clamps shall be of standard design and fabricated from galvanized MS standard flats 40x3 mm thick and 12 mm dia MS rod and 6 mm nuts and bolts. Holder bat clamps shall be fixed in cement concrete 1: 2 : 4 mix blocks 10x10x10 cms deep.

4.2 Where holder bat clamps are to be fixed in RCC column or slotted angles, walls or beam they shall be fixed with galvanized 40x3 mm flat iron "U" type clamps with anchor fasteners of approved design or 6 mm nuts and bolts.

4.3 For SWR pipes conforming to IS: 13592 shall be clamped to wall with approved type of uPVC saddle clamp/U-clamp or as given in the Bill of quantities.

4.4 Structural clamps shall be fabricated by electro-welding from MS structural members e.g. rods, angles, channels flats as per detailed drawing. Contractor shall provide all nuts & bolts, welding material. All fabricated clamps, nuts, bolts and washers shall be not dipped galvanized.

4.5 Galvanized slotted angle/channel supports on walls shall be provided wherever shown on drawings. Angles/channels shall be of sizes shown on drawings or specified in schedule of quantities. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. The spacing of support bolts horizontally shall not exceed 1 m.

4.6 Wherever MS clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and making good with cement

concrete 1 : 2 : 4 mix (1 cement : 2 coarse sand : 4 mm stone aggregate 20 mm nominal size) as directed by the Project Manager.

4.7 For sleeves, anchor fasteners and clamp spacing chart shall be as follows:

MARKINGS:
All pipes shall carry the following markings: Time and date of manufacture; company name; dimension, application class, barcode and material details.
FITTINGS:
Single- Layered fitting in PP, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to EN 1451-PART 1-6EN 12056 PART 1-5.
INSTALLATION: The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The piping must not touch any wall, structure, paneling, false ceiling etc.

5.0 Traps

5.1 Floor traps

Floor traps shall be siphon type full bore P or S type cast iron having a minimum 50 mm deep seal. The trap and waste pipes in sunken area (where required) shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1 : 2 : 4 mix (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size) and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30 cms of the required depth.

5.2 Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type inlet fitting fabricated from uPVC pipe without, with one, two or three inlet sockets fixed on side to connect the waste pipe. Joint between waste and hopper inlet socket of the trap shall be joined with solvent cement recommended by the manufacturer. Inlet shall be connected to an uPVC. P or S trap. Floor trap inlet hoppers and the traps if set in cement concrete blocks as specified in para above without extra charge. UPVC multi-inlet trap can be used where ever possible to be decided by the project Engineer.

Trap & Seals

All traps shall be self cleaning design and the seal depth shall be as specified below wherever the traps are not integral with the appliances:

Appliance or ware	Material	Trap Type	Seal depth(mm)
Lavatory /wash basin	C.P. cast brass	32 mm dia Bottle	75 mm
Sink	C.P. cast brass	40 mm dia Bottle	75 mm
Kitchen floor drain of fabricated drain boxes	uPVC/C.I.	75/100 mm dia 'P' or 'S'	50 mm
Urinals	uPVC/C.I.	100 mm dia 'P' or 'S'	50 mm

5.3 Floor Gratings

Floor and urinal traps shall be provided with 100-150mm square or round CP/stainless steel grating, with rim of approved design and shape. Minimum thickness shall be 4 mm or as specified in the Schedule of Quantities

5.4 Jointing

Pipe to pipe and pipe to fitting (SWR) joint shall be with 'O' rubber ring as recommended by the manufacturer. Jointing with solvent cement shall be applied to uPVC waste pipes (confirming to I.S. 4985) and fittings or as recommended by the manufacturer's.

6 Cleanout Plugs

6.1 PP Clean out pipe for Soil, Waste pipes laid under floors shall be provided near pipe junctions bends, tees, "Ys" and on straight runs at such intervals as required as per site conditions. Cleanout pipe shall terminate flush with the floor levels.

6.2 Cleanout on Drainage Pipes

a) Cleanout pipe shall be provided on starting point of each drain and in between at locations indicated on plans or directed by the Project Manager. Cleanout pipe shall be of size matching the full bore of the pipe but not exceeding 160 mm OD.

b) Cleanouts at ceiling level pipe shall be provided with a bend terminating at floor level above. The cap of the cleanout pipe shall have a cap flush with floor.

7.0 Waste pipe from appliances

7.1 **General**

a) Waste pipe from appliances e.g. wash basins, sinks and urinals shall be of noise insulated Polypropylene piping system as per DIN EN 12056 and DIN1986-100 with 3 layer pipe made of External layer -PP, middle layer-Mineral reinforced PP, Internal layer-PP. push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 10 dBA as per DIN 4109 at a flow rate of 2 l/s and having pipe ring stiffness as per 1S0/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density of pipe = 1.9 g/cm3, elongation break 50% and tensile strength 20 N/mm2,Coefficient of linear expansion 0.09 mm/mK PP pipe 40, 50 mm OD as given in the Schedule of Quantities.

b) All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on galvanized structural clamps. Spacing for clamps for such pipes shall be as per the pipe spacing chart given in section 1.

8.0 Encasing pipe in Cement Concrete

uPVC soil and waste pipes and drainage under floor in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1 : 2 : 4 mix (1 cement : 2 coarse sand : 4 stone aggregate 12 mm size) 75 mm in bed and all-round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height at intervals of one meter. Rate for concreted round pipes shall be inclusive of pillars, supports, shuttering and centering.

9.0 Cutting and making good

9.1 Contractor's rate shall include for providing all necessary holes, sleeves, cut outs and chases in structural members as building work proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1 : 2 : 4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm

nominal size) or cement mortar 1 : 2 (1 cement : 2 coarse sand) and the surface restored as in original condition.

10.0 Testing

10.1 Testing procedure specified below apply to all soil, waste and vent pipes above ground including pipes laid along basement ceiling.

10.2 Entire drainage system shall be tested for water tightness during and after completion of the installation. No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber/bellow plugs, manometers, smoke testing machines, pipe and fitting work test benches and any other equipment necessary and required to conduct the tests. All testing equipment/motors etc. shall be certified for its calibration by an approved laboratory.

10.3 All materials obtained and used on site must have manufacturer's hydraulic test certificate for each batch of materials used on the site.

10.4 Testing soil, waste and rainwater pipes

a) Apart from factory test all pipes and fittings shall be hydraulically tested for a head of 3 m preferably on a specially set up work bench. After applying pressure, strike the pipe with a wooden pallet and inspect for blow holes and cracks. Pressure may be applied for about 2 minutes. Reject and remove all defective pipes.

b) After installation all connections from fixtures, vertical stacks and horizontal drains including pipes along ceiling shall be tested to a hydraulic pressure not exceeding 3 m. Such tests shall be conducted for each floor separately by suitable plugs.

c) After the installation is fully complete, it should be tested by flushing the toilets, running at least 20% of all taps simultaneously and ensuring that the entire system is self draining, has no leakages, blockages etc. Rectify and replace where required.

10.5 Contractor shall maintain a test register identifying date and time of each area. All tests shall be conducted in presence of Project Manager and signed by both.

11 Measurements

11.1 General

a) Rates for all items quoted shall be inclusive of all work and items given in the specifications and Schedule of Quantities.

b) Rates are applicable for the work in basements, under floors, in shafts at ceiling level area for all heights and depths.

c) Rates are inclusive of cutting holes and chase in RCC and masonry work and making good the same.

d) Rates are inclusive of pre testing, on site testing, of the installations, materials and commissioning of the works.

e) Pipes (unit of measurement. Linear meter to the nearest centimeter)

11.2 Pipes shall measured per running meter correct to a centimeter for the finished work which shall include fittings e.g. bends, tees, crosses, etc. The length shall be taken along centre line of the pipes

and fittings. All pipes and fittings shall be classified according to their diameter, method of jointing and fixing substance, quality, and finish. The diameters shall be nominal outer diameter.

11.3 Cement concrete around pipes shall be measured along the center of the pipe line measured per linear meter and include any masonry supports, shuttering and centering cutting complete as described in the relevant specifications.

11.4 Slotted angles/channels shall be measured per linear meter of finished length and shall include support bolts, nuts and clamps embedded in masonry walls with cement concrete blocks and nothing extra will be paid for making good the same.

11.5 Fittings

Unit of measurement shall be the number of pieces. Pipe fittings are included in the rate for pipes. Urinal traps, trap gratings, hoppers, cleanout plugs shall be measured by number per piece and shall include all items described in the relevant specifications and Schedule of Quantities.

11.6 Excavation for soil pipes

No payment shall be admissible with respect to excavation, refilling and disposal of surplus earth for soil and waste pipes laid below ground, in sunken slabs or over basement rafts.

11.7 Project Manager's decision with respect to the correct interpretation regarding mode of measurement shall be final and binding on the contractor.

SECTION III : WATER SUPPLY SYSTEM

4. WATER SUPPLY SYSTEM

4.1 **Scope of Work**

4.1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the Schedule of Quantities.

4.1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-

a) Distribution system from main supply headers to all fixtures and appliances for cold/hot water.
b) Cold water supply lines from tube-wells to underground water tanks.
c) Bore-well connections to U.G. water tanks.
d) Garden irrigation system if any
e) Excavation and refilling of pipes trenches.
f) Insulation to hot & cold water pipes.
g) To all the flushing in WC and Urinal should be done by the cold water supply by hydropenumatic system and all the domestic water required for wash basin, shower, and kitchen should be done by the hot water supply.
h) All the concealed by should be insulated by rubber nitrile insulation and all the exposed to wall pipe in the terrace and shaft by the aluminium cladding insulation with rockwool.
i) Pipe protection and painting.
j) Control valves, masonry chambers and other appurtenances.
k) Connections to all plumbing fixtures, tanks, appliances and Municipal mains

4.2 **General Requirements**

4.2.1 All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Project Manager.

4.2.2 Pipes and Fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

4.2.3 Short or Long bends shall be used on all main pipe lines as far as possible. Use of Elbows shall be restricted for short connections.

4.2.4 Pipes shall be fixed in a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

4.2.5 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.

4.2.6 Clamps, hangers and supports on RCC walls, columns and slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

4.2.7 All pipe clamps, supports, nuts, bolts, washers shall be galvanized MS steel throughout the building. Painted MS clamps & MS nuts, bolts and washers shall not be accepted.

4.2.8 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

4.3 **Water Supply System**

4.3.1 Contractor should study the site plan and water supply system diagram for an overview of the system.

4.3.2 Source

Water supply will be acquired from tube-wells within the site and collected in underground water storage tanks.

4.4.1 **Pipe Supports**

4.4.1.1 All pipes clamps, supports, hangers, rods, pipe supports, nuts and washers shall be factory made galvanized MS steel or alternatively galvanized after fabrication to suit site requirements.

4.4.1.2 PP-R pipes in shafts and other locations shall be supported by galvanized M.S clamps of design approved by pipes in wall chases shall be anchored by G.I hooks, pipes at ceiling level shall be supported on structural clamps fabricated from M.S structural steel. Pipes in typical shafts shall be supported on Galvanised slotted angles/channels as specified elsewhere.

4.4.1.3 Clamps

G.I. pipes in shafts and other locations shall be supported by M.S. clamps of design approved by Project Manager. Pipes in wall chases shall be anchored by iron hooks, Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural steel as described above. Pipes in typical shafts shall be supported on slotted angles/channels as specified.

4.5 **Anchor Fasteners**

4.5.1 All pipes supports, hangers and clamps to be fixed on RCC walls, beams, columns, slabs and masonry walls 230mm thick and above by means of galvanised expandable anchor fasteners in drilled holes of correct size and model to carry the weight of pipes. Drilling shall be made only by approved type of power drill as recommend and approved by manufacturer of the anchor fasteners. Failure of any fastening devices shall be the entire responsibility and contractor shall redo or provide additional supports at his own cost. He shall also compensate the owner for any damage that may be caused by such failures.

4.6 **Unions**

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by Project Manager.

4.7 **Flanges**

Flanged connections shall be provided on pipes as required or where shown on the drawings, all equipment connections as necessary and required or as directed by connections shall be made by the correct number and size of GI nuts, bolts & washers with 3 mm thick gasket. Where hot water or

steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by Bolt hole dia for flanges shall conform to match the specification for C.I. sluice valve to I.S.780 and C.I. butterfly valve to IS: 3095.

4.8 **PP-R pipes, fittings & valves**

4.8.1 All pipes inside the buildings and where specified, outside the building shall be 3 layer PP-R (Poly propylene Random copolymer) pipes conforming to IS: 15801, UV stabilized and anti-microbial fusion welded, having thermal stability for hot and cold water supply.

4.8.1 **JOINING PIPE & FITTINGS**

a. Cutting

Pipes 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.

b. Deburing/ Beveling

Burrs and fittings should be removed from the outside and inside of pipe with a pocket knife or file otherwise burrs and fittings may prevent proper contact between pipe and fitting during assembly.

c. Fitting Preparation

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

d. Assembly

After applying the solvent cement on both pipe and fitting socket, pipes should be insert into the fitting socket within 30 seconds, and rotating the pipe ¼ to ½ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approx) in order to allow the joint to set up.

An even bead of cement should be evident around the joint and if this bead is not continuous, remake the joint to avoid potential leaks.

Set & Cure times:

Solvent cement set & cure times shall be strictly adhered to as per the below mentioned table:

Minimum Core prior to pressure testing at 150 psi

S.no	Ambient Temperature during Core period	Pipe Size	
		½" to 1"	$1^{.1/4"}$ to 2"
1	Above 15 deg C	1 Hr	2 Hrs
2	4 – 15 deg C	2 Hrs	4 Hrs
3	Below 4 deg C	4 Hrs	8 Hrs

e. Once an installation is completed and cored as per above mentioned recommendations, the system should be hydrostatically pressure tested at 150 psi (10 Bar) for minimum 24hrs.During pressure testing the system should be filled with water and if a leak is found, the joint should be cut out and replacing the same with new one by using coupler.

4.8.2 **Transition of PP-R to Metals**

When making a transition connection to metal threads, special brass/plastic transition fitting (Male & Female adopters) should be used. Plastic threaded connection should not be over torque Hard tight pluts one half turn should be adequate.

4.8.3 **Threaded Sealants**

Teflon tapes shall be used to make threaded connection leak proof.

4.8.4 **Hangers & Supports**

For horizontal runs, support should be given at 3 ft (90 cms) intervals for diameter of 1" and below and at 4 ft (1.20 mtr) intervals for larger size.

Hangers should not have throw or sharp edges which come in contact with the tubing and shall be of GI.

Support should be as per the below mentioned table:

S.No	Size of Pipe	21^0C	49^0C	71^0C	82^0C
	Inch	Ft	Ft	Ft	Ft
1	½"	5.5	4.5	3.0	2.5
2	¾"	5.5	5.0	3.0	2.5
3	1"	6.0	5.5	3.5	3.0
4	$1^{1/4}$"	6.5	6.0	3.5	3.5
5	$1^{1/2}$"	7.0	6.0	3.5	3.5
6	2"	7.0	6.5	4.0	3.5

4.8.5 All special fittings and accessories like internally or externally threaded brass adaptors, ball valves, globe valves, unions, diaphragm valves, butterfly valves; etc shall be made of CPVC by licensee.

4.8.7 Concealed Plumbing:

All internal concealed plumbing for hot & cold water supply shall be done with 3-layer PP-R pipe confirming to IS-15801 with all the necessary fittings.

4.10 **Thermal Insulation**

All the concealed water supply pipes in the toilet will be insulated by the rubber nitrile insulation and all the exposed to wall pipe shall be done by the rockwool insulation with aluminium cladding.

- Thermal insulation over domestic water supply pipes in shaft & Terrace in accordance with specifications rockwool 144 Kg / Cu-m density with Al cladding of 24 G. in all joints complete as per manufactuer's specifications.Insulation for Exposed on wall pipe (Terrace & Shaft Pipe)

Dia of pipe	OD after insulation
15 mm	65 mm OD with insulation
20 mm	70 mm OD with insulation
25 mm	75 mm OD with insulation
32 mm	82 mm OD with insulation
40 mm	90 mm OD with insulation
50 mm	100 mm OD with insulation
65 mm	145 mm OD with insulation

Thermal insulation over domestic water supply pipes in concealed work Nitrile rubber insulation of 13 mm thick on cold and hot water pipes complete with outer mechanical protection as per specification. in all joints complete as per manufactuer's specifications.

Dia of pipe	OD after insulation
15 mm	28 mm OD with insulation
20 mm	33 mm OD with insulation
25 mm	38 mm OD with insulation
32 mm	45 mm OD with insulation

4.10 **Trenches**

All water supply pipes below ground shall be laid in trenches with a minimum cover of 60 cms. The width and depth of the trenches shall be as follows

Dia of pipe	Width of Trench	Depth of Trench
15mm to 50mm	30 cms	75cms
65mm to 100mm	45 cms	100 cms

4.11 **Sand filling**

Pipes in trenches shall be protected with fine sand 15 cms all round before filling in the trenches.

Painting

4.10.1 All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard color code given in this document or specified by Project Manager.

4.11 **Pipe protection**

4.11.1 All GI pipes in eternal work shall be protected against corrosion by the application of two coats of bitumen paint covered with polythene tape and a final coat of bitumen paint.

4.11.2 G.I. water supply pipes, if buried in ground or sunken slab, shall be protected with multi layer bitumen membrane tape 3mm thick with a final coat of hot or cold applied bitumen. "Pypkote" or equivalent.

4.12 **Valves**

4.12.1 **Ball Valves**

Valves upto 50 mm dia. shall be screwed type Ball Valves with stainless steel balls spindle teflon seating and gland packing tested to a hydraulic pressure of 16 kg , sq.cm., and accompanying couplings and steel handles.(to BS 5351) protected with thermal insulation.

4.13 **Butterfly Valves – Slim Seal Type**

4.13.1 Valves 65 mm dia and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle.

4.13.2 Butterfly valve shall be of best quality conforming to IS: 13095.

4.14. **Non Return Valve (Dual Slim Type)**

Where specified, non return valve shall be provided through which flow shall occur in one direction only.

Each Butterfly and Slim Type Swing Check (NRV) Valve shall be provided with a pair of flanges screwed or welded to the main line and having the required number of nuts, bolts and washers of correct length.

4.15. **Storage tanks Overhead Tank. (Accessories & Connections)**

4.15.1 Storage tanks for water supply shall be SS insulated tank in Type-4 accomodation and RCC tank in Staff hostel

SS Tank inner material should be SS 316 and outer should be SS 304 material with inner dia 850 mm and outer dia 1050 mm with PUF insulation for 1000 litre tank.

4.16 Outlets and overflow

All nozzles for puddle flanges in RCC tank for inlet, outlet, overflow and scour etc. shall be provided by civil contractor or as given in the Schedule of Quantities, further connections and accessories shall be provided under this contract.

4.17. Testing

All pipes, fittings and valves, after fixing at site, shall be tested by hydrostatic pressure of 1.5 times the working pressure or 7 kg / sq.cm whichever is more.
Pressure shall be maintained for a period of at least thirty minutes without any drop. A test register shall be maintained and all entries shall be signed and dated by Contractor (s) and Project Manager.

In addition to the sectional testing carried out during the construction, Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes' or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor during the defects liability period without any cost.

After commissioning of the water supply system, Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves, which do not effectively operate, shall be replaced by new ones at no extra cost and the same shall be tested as above.

Hot water pipes chased into the walls shall be provided with a 6mm thick insulation with elastic flexible material having hermetic closed cell structure of expanded synthetic material rated for 60ºC hot water supply.

4.18 Measurement

a) Pipes above ground shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, flanges and U clamps with nuts, bolts & washers fixed to wall or other standard supports.

b) Jointing with Teflon tape, White lead, solvent, and crimping and insertion gasket of appropriate temperature grade.

c) Cutting holes, and chases in walls, floors, any pipe support required for pipes below ground & making good the same.

d) Excavation, backfilling, disposal of surplus earth and restoring the ground & floor in original condition.

4.19 Pipe Supports

Fabricated and / or galvanised supports shall be measured by weight. Weight for each type of clamp shall be calculated on basis of the quantity of structurals and MS used from the theoretical weight calculated on basis of the components theoretical weight of the sections.

4.20 Rate quoted for supports & hangers shall be inclusive of:

a) Expandable anchor fastens.
b) Galvanising of all supports & hangers.

c) Cutting holes in walls, ceilings on floors and making good where permitted.
d) Nuts, bolts and washers for fixing and assembling.
e) Wooden / PVC pipe saddles for vertical or horizontal runs.

4.21 Valves

Gunmetal, cast iron, butterfly and non return valves and puddle flanges shall measured by numbers and shall include wheels I caps, GI nuts, bolts, washers, insertion gasket.

4.22 Painting/pipe protection/insulation

Painting/pipe protection /insulation for pipes shall be measured per linear meter over finished surface and shall include all valves and fittings for which no deduction shall be made. No extra payment shall be made for fittings, valves or flanges.

TECHNICAL SPECIFICATIONS FOR EXTERNAL SEWERAGE WORK

SECTION I

SPECIAL CONDITIONS OF CONTRACT

1.0 **Scope of Work**

1.1 The form of Contract shall be according to the "conditions of Contract". The following clauses shall be considered as an extension and not in limitation of the obligation of the Contractor.

1.2 Work under this Contract shall consist of furnishing all labor, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings.

2.0 **Specifications**

2.1 Work under this Contract shall be carried out strictly in accordance with specifications attached with the tender.

2.2 Items not covered under these specifications due to any ambiguity or misprints, or additional work, the work shall be carried out as per specifications of the latest Central Public Works Department with upto date amendments as applicable in the Contract.

2.3 Works not covered under para 2.1 and 2.2 shall be carried out as per relevant Indian Standards and in case of its absence as per British Standard Code of Practice.

3. **Execution of work**

3.1 The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding incorrect information on any of these points or on ground of insufficient description will be allowed.

3.2 The work shall be carried out in conformity with the plumbing drawings and within the requirements of architectural, electrical, structural and other specialized services drawings.

3.3 The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule.

3.4 On award of the work, contractor shall submit a schedule of construction in the form of a pert chart or bar chart for approval of the Consultant/Owner. All dates and time schedule agreed upon should be strictly adhered to, within the stipulated time of completion/ commissioning along with the specified phasing, if any.

3.5 The contractor shall be required to maintain the monthly record of Progress of work as well as the quality of working by taking periodical photographs and submit the same regularly to the Consultant/Owner.

4.0 **Drawings**

4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the architectural and other services drawings.

4.2 Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.

4.3 Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small-scale drawings.

5.0 **Inspection and testing of materials**

5.1 Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian Standards.

6.0 **Metric conversion**

6.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.

6.2 Any weights or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

7.0 **Reference drawings**

7.2 All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. All changes to be made shall be initialed by the Consultant/Owner.

8.0 **Shop drawings**

8.1 The Contractor shall submit to the Consultant/Owner four copies of the shop drawings.

8.2 Shop drawings shall be submitted under following conditions:

a. Showing any changes in layout in the plumbing drawings.

b. Layout showing all invert level coordinated with all services dwg.

8.3 The Contractor shall submit four copies of catalogues, manufacturer's drawings, equipment characteristics data or performance chart with the name and address of manufacturer for all electrical and mechanical equipment provided by him after due approval as required by the Consultant/Owner.

9.0 **Completion drawings**

9.1 On completion of work, Contractor shall submit one complete set of original tracings and two prints of "as built" drawings to the Consultant/Owner. These drawings shall have the following information:

a. Run of all piping, diameters of pipes and location of external services.

b. Ground and invert levels of all drainage pipes together with location of all manholes and connections upto outfall.

c. Run of all water supply lines with diameters, locations of control valves access panels.

d. Location of all mechanical equipment with layout and piping connections.

No completion certificate shall be issued unless the above drawings are submitted.

9.2 Contractor shall provide four sets of catalogues, manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacture for all electrical and mechanical equipment provided by him.

9.3 All "warranty cards" given by the manufacturers shall be handed over to the Consultant/Owner and shall be in the name of the Owner.

10.0 **Contractor's rates**

10.1 Rates quoted in this tender shall be inclusive of cost of materials, labor, supervision, erection, tools, plant, scaffolding, service connections, transport to site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

10.2 Rates quoted are for all heights and depths and in all positions as may be required for this work.

10.3 All rates quoted must be for complete items inclusive of all such accessories, fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specifically mentioned otherwise.

10.4 All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/concrete of appropriate mix and strength as directed by Consultant/Owner. Contractor shall provide holes, sleeves, and recesses in the concrete and masonry work as the work proceeds.

10.5 The Contractor shall furnish the Consultant/Owner with vouchers, on request, to prove that the materials are as specified and to indicate that the rates at which the materials are purchased in order to work out the rate analysis of non tendered items which he may be called upon to carry out.

11.0 **Testing**

11.1 Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.

11.2 All Tests shall be performed in presence of the Consultant/Owner.

11.3 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.

11.4 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other byelaws in force.

11.5 Contractor shall provide all labor, equipment and materials for the performance of the tests and shall not be paid any extra on that account.

12.0 **Site clearance and cleanup**

12.1 The Contractor shall, from time to time, clear away all debris and excess materials accumulate at the site.

12.2 After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discoloration leaving the same in a ready to use condition.

13.0 **License permits and authorities**

13.1 Contractor must hold a valid plumbing or any other as required license by the Municipal Authority or other competent authority under whose jurisdiction the work falls.

13.2 Contractor must keep constant liaison with the Municipal/statutory authority and obtain approval of all drainage, water supply and other works carried out by him.

13.3 Contractor shall obtain, from the municipal and other authorities completion certificate with respect to his work as required for occupation of the building and nothing extra shall be paid on this account.

14.0 **Cutting of structural members**

14.1 No structural member shall be chased or cut without the written permission of the Consultant/Owner.

15.0 **Materials**

15.1 Unless otherwise specified and expressly approved in writing by the Consultant/Owner, only materials of makes and specifications as mentioned in the list of approved makes attached with the specifications shall be used.

15.2 The Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Consultant/Owner and returned to the Contractor at the appropriate time.

SECTION II: SEWAGE

1. Sewer work

1.1 Scope of work

1.1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all the drainage system as required by the drawings and specified hereinafter or given in the Schedule of Quantities.

1.1.2 Without restricting to the generality of the foregoing, the drainage system shall include:-

a) Sewer lines including excavations, pipelines, manholes, drop connections and connections to the existing sewer.

b) Storm water drainage, excavation, pipelines, manholes, catch basins, drain channels and connections to the existing storm water drain.

1.2 General requirements

1.2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of the Project Manager.

1.2.2 Drainage lines and open drains shall be laid to the required gradients and profiles.

1.2.3 All drainage work shall be done in accordance with the local municipal bye-laws.

1.2.4 Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority.

1.2.5 Location of all manholes, etc. shall be got confirmed by the Contractor from the Architect / Landscape Architect. As far as possible, no drains or sewers shall be laid in the middle of road unless otherwise specifically shown on the drawings or directed by the Project Manager.

1.2.6 In sewer line pipe DWC HDPE SN8 confirming to 16098 Part II pipe will be used.

1.3 **DWC HDPE Pipes (SN 8): IS 16098 Part II**

1.3.1 DWC pipes shall be of first class quality and free from rough texture inside or outside and straight. All pipes shall have the manufacturers name marked on it and shall comply with IS-16098 Part II and shall be of approved makes.

1.3.2 **<u>Laying and Jointing of DWC HDPE Pipes</u>**

a) Pipes are liable to be damaged in transit and notwithstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works prevented.

b) The pipes shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.

c) Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried too low it shall be made up with cement concrete 1:5:10 mix at the Contractor's cost and charges.

d) If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed of 1:5:10 mix to ensure even bearing.

1.3.5 **Jointing of Pipes**

a) Tarred gaskin shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.
b) The remainder of the socket shall be filled with stiff mix of cement mortar (1 cement: 1 clear sharp washed sand). When the socket is filled, a fillet should be formed round the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe. The mortar shall be beaten up and used after it has begun to set.
c) After the joint has been made any extraneous materials shall be removed from inside of the joint with a suitable scraper or "Badger". The newly made joints shall be protected until set from the sun, drying winds, rain or dust. Sacking or other materials, which can be kept damp, shall be used. The joints shall be exposed and space left all rounds the pipes for inspection by the Project Manager. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

1.4 Testing

- All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water. The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

- Sewer lines shall be tested for straightness by: (i) inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end. (ii) means of a mirror at one and a lamp at the other end. If the pipeline is straight the full circle of light will be seen otherwise obstruction of deviation will be apparent.

- The Contractor shall give a smoke test to the drains and sewer at his own expense and charges, if directed by the Project Manager.
  A test register shall be maintained which shall be signed and dated by Contractor.

SECTION III : PUMPS & EQUIPMENTS .

3.0 **Pumps & Equipment**

3.1 Work under this sub-head consists of furnishing all labour, materials, equipment and accessories necessary and required to completely install pumping system for various water supply services and water treatment as per drawings, specified hereinafter and given in the Bill of Quantities.

3.2 Without restricting to the generality of the foregoing, the work of pumps and water treatment equipment shall include the followings:
a) Hydropneumatic pump for domastic water supply
b) Motor control panels, power and control cabling and allied electrical works.
c) Pipes, valves, accessories, hangers, supports, delivery and suction feeders and connection to proposed pipe work.

3.3 **PUMP SET**

3.3.1 **Water Supply Pumps**

(These specifications are applicable for all clear water pumps and as specified in Bill of Quantities)

3.3.2 Water supply pumps shall be suitable for clean water. Pumps shall be single or multistage, monoblock horizontal, vertical, centrifugal pumps with cast iron/stainless steel body and stainless steel/bronze impeller, stainless steel shaft and coupled to a TEFC electric motor by means of a flexible coupling or as specified in bill of quantities. Each pump should operate a curve 10m below specified head.

3.3.3 Pump and motor shall be mounted on a common M.S. structural or C.I. base plate or as required as per site conditions.

3.3.4 Each pump shall be provided with a totally enclosed fan cooled induction motor of required H.P. and RPM specified in the bill of quantities and as per requirement.

3.3.5 Each pumping set shall be provided with a 150mm dia or of suitable size gunmetal "Bourden" type pressure gauge with gunmetal isolation cock and connecting piping.

3.3.6 Provide vibration-eliminating pads appropriate for each pump.

3.3.7 Provide rate of flow measuring meter with bypass arrangement with every set of pumps as shown on the drawings and given in the bill of quantities (to be paid separately).

3.3.8 All water supply pumps shall be provided with mechanical seals, of required specifications.

3.4 **PIPING**

3.4.1 Pipes for suction and delivery shall be galvanized/M.S tube (heavy duty) confirming to I.S:1239 upto 150mm dia and as per I.S:3589 for dia 200mm and above or as specified in bill of quantities. The M.S flanges shall confirm to I.S:6392-1971.

3.4.2 Gate valve and check valve above 65mm dia shall be C.I. double flanged conforming to I.S:780 manufactured by the reputed manufacturers or C.I. double flanged butterfly valves as specified in bill of quantities or elsewhere or as per approval of Engineer-in-charge.

3.4.3 Full way and check valves 65mm dia and below shall be gunmetal tested to 20Kg/cm^2 pressure certified and conforming to I.S:778.

3.4.4 Suction strainer or foot valves shall be C.I., confirming to I.S:4038 - 1979, as specified in bill of quantities.

3.4.5 **Joints**

All pipes and fittings shall be provided with flanged joints, with flanges either screwed or welded complete and jointed with 1.5mm thick gasket complete with nuts, bolts and washers etc.

3.4.6 **Testing**

All G.I/M.S pipes (except fire pipe) shall be tested hydrostically for a period of 30 minutes to a pressure of 7 Kg/cm^2 without drop in pressure and all G.I/M.S pipes for fire shall be tested hydrostically for a period of 30 minutes to a pressure of 10 Kg/cm^2 without drop in pressure.

3.5 **MEASUREMENTS**

3.5.1 Raw water, garden pump and other pumps shall be measured by numbers and hydro pumps and sump pumps shall be measured by sets and shall include all items as given in the bill of quantities.

3.5.2 Motor control panel and level controllers shall be measured by numbers.

3.5.3 Pipes for suction and delivery header and mains shall be measured per linear metre along the centre line of the pipe and shall be inclusive of all fittings.

3.5.4 Cable trays and cables shall be measured per linear meter.

3.5.5 Structural clamps including hangers shall be measured by weight calculated from sections used. No separate payment shall be admissible for bolts, anchor bolts, rawl plugs etc.

3.5.6 No separate payment shall be made for making connections of the existing service lines to the pumps. Vibration eliminator pads are included in the scope of this work.

3.6 **GUARANTEE**

3.6.1 The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.

3.6.2 The form of warranty shall be as approved by the Engineer-in-charge.

3.6.3 The warranty shall be valid for a period of one year or, as per warranty period provided by manufacturers which ever is highr from the date of commissioning and handing over.

3.6.4 The warranty shall expressly include replacement of all defective or under capacity equipment, Engineer-in-charge may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.

3.6.5 The warranty shall include replacement of any equipment found to have capacity lesser than the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Engineer-in-charge.

PARTICULAR SPECIFICATION OF ELECTRICAL WORK

1 SCOPE OF WORK

The general character and the scope of work to be carried out under the contract are illustrated in Drawings and BOQ. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer In charge. The contractor shall furnish all labour, materials and equipment as listed in specifications and drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The complex includes Staff hostel and Type-4 accommodation etc. **All the components, materials, accessories & equipment shall be supplied & designed as per -30^{o} C ambient temperature and about 3525 meters MSL. If the specification of items will increase as per the altitude above, the feasible specification shall be followed without cost increase.**

The system includes:

a) Wiring for Normal Electric supply & Emergency supply shall be done in PVC conduit / Cable tray/ Raceway system as per drawings.
b) Switches, plug sockets, cover plates and other wiring accessories.
c) Sub-Mains wires/cables from panel to respective flat DB/Floor.
d) Distribution boards
e) Cables on cable trays including installation, cable trays, hangers, supports, cable terminations and all fixing accessories.
f) Earthing (Grounding) System and Lightning Protection System.
g) Main LT Panels & Distribution Panels. The general construction shall confirm to IEC:61439 -1/2.
h) All cabling from main LT panel at to each respective distribution panels on each floor.
i) Hi Side equipments like HT VCB Panel, Transformer and Servo stabilizer.
j) Diesel generator set
k) Lighting Fixtures and Fans

2 RELATED DOCUMENTS

These Specifications shall be read in conjunction with the CPWD General specification for Electrical work Part-1 Internal (2013), Part-2 External (1994), Part-4 Substation and Part-7 DG Sets (2013), drawings and other document connected with the work.

3 SUB MAINS AND POINT WIRIN

3.1 Scope

The scope of this section comprises the supply, installation, testing and commissioning of following as per drawings:

1. Wiring for power outlets, heavy duty sockets/industrial sockets.

2. Wiring from distribution boards to different switchboards and from there onwards to individual points like light points, Bell Buzzers, Fan points and small exhaust fan points etc for all internal areas.
3. Switchboards, power plugs and its accessories like gang box, front plate, switch etc.
4. Wires and its accessories like conduits, Outlet boxes, junction boxes, pull-through boxes etc.
5. Ceiling rose, Connectors etc. for light points, Fan points, small exhaust fan points etc for all internal areas.
6. Conduit/channel as the case may be, accessories for the same and wiring cables between the switch box and the point outlet, loop protective earthing of each fan/ light fixture.
7. All fixing accessories such as clips, screws, raw plug etc. as required.
8. Metal switch boxes (as specified) for control switches, regulators, sockets etc, recessed or surface type, and phenolic laminated sheet covers over the same.
9. Control switch or MCB, as specified in drawings.
10. Connections to ceiling rose, connector, socket outlet, switch etc.
11. Flexible conduits from ceiling junction box to the fittings shall be provided duly coupled at both ends where false ceiling is coming. This shall be included within the scope of point wiring.)
12. Interconnecting wiring between switches within the switch box on the same circuit.

3.2 Codes & Standards

More particularly following documents should be strictly followed.

1. CPWD General Specification for Electrical work Part-1 Internal (2013)
2. CPWD General Specification for Electrical work Part-2 External (1994)
3. CPWD General Specification for Electrical work Part-4 Substation (2013)
4. CPWD General Specification for Electrical work Part-7 D.G sets (2013)
5. National Building Code - 2016
6. National Electrical Code - 2008
7. Indian Electricity Act 2003
8. Indian Electricity Rule 1956

Apart from above the relevant Bureau of Indian Standard codes as more particularly stated herein and broadly to all the codes, status and regulations as applicable shall be strictly enforced and adhered to.

3.3 Specifications

3.3.1 Wires:

The wires shall be PVC Insulated Copper Conductor multi strained FRLS confirming to IS: 694 and amendment up to date.

a. Wires from light/Fan circuit wiring and point wiring (along with internal loop earthing) shall be of 1.5 sq.mm size.
b. Wires from DB to 6A Socket outlet (along with internal loop earthing) shall be of 2.5 sq.mm size.
c. Wires from DB to 6/16A Socket outlet (along with internal loop earthing) shall be of 4 sq.mm. Size.
d. Wires from DB to Split AC, Geyser, Industrial sockets and Sheet steel MCB/MCCB box shall be as per drawings.

3.3.2 Thimbles/lugs:

The wires shall be terminated with the help of crimping lugs at both the terminals. The lugs shall be suitable for 1100V and the min temperature rating for these lugs shall be 150 degree Celsius. The lugs shall be pin/Hole type with pin designed in such a fashion to prevent damage to the wire from over tightening and ensure a reliable electrical connection. If Aluminum cable is used, aluminium lugs shall be used, for copper cables, copper lugs shall be used and if cable termination is of Aluminium conductor and main busbar is copper than tinned copper or bi-metallic lugs shall be used.

3.3.3 PVC conduits and accessories:

Wiring for Light/ Fan/Call Bell/Exhaust Fan point and circuit wiring and power wiring shall be done in PVC steel conduit confirming to IS: 2509 (1973) and IS: 3419 (1989) latest as on date for rigid conduit and IS: 9537 (Part-5) (2000) latest as on date for flexible conduit.

3.3.4 Modular GI Box:

The switch box for mounting modular switches and sockets shall be made out from pre galvanized sheet. The modular GI box having wall thickness not less than 1.2mm for boxes up to size of 20 cm X 30 cm and above this size of 1.6 mm thick shall be used.

3.3.5 Modular Base and cover plate:

The front plate shall have smooth surface from both the side and shall be properly matching the fixing alignment. Perfect alignment shall be maintained while fixing of the back boxes. The color shall be as per the engineer in-charge.

3.3.6 Switch - Socket Outlets:

The switch sockets shall be modular type of reputed make mentioned in preferred approved make list.

3.3.7 Blanking Plate:

Spare space in modular switch box shall be covered by blanking plate.

3.3.8 Electronic fan regulator:

Step Type two module Electronic regulators should be used.

4 DISTRIBUTION BOARD

4.1 Distribution Boards

The distribution board shall be made out of CRCA sheet steel with powder coated double metallic door with minimum IP: 42 protection compliance to IS: 8623-1 and 3 and IEC 61439-1 & 3 and amendment up to date.

5 CABLES TRAYS

Cable tray system shall comprise of perforated painted with powder coating M.S. cable trays with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with M.S. suspenders including bolts& nuts, painting suspenders including bends, Tee joints, Cross member and reducers etc as required. Refer all specification other than material from CPWD Part-I.

6 PROECTION OF BUILDING AGAINST LIGHTNING

This chapter covers the detailed requirements of installation of lightning conductor system for protection of buildings against lighting. For details not covered in these specifications, reference may be made to IS: 2309 - 1989.

The principal components of a lightning protective system are:

a) Air Terminations
b) Down Conductors
c) Joint and Bonds
d) Testing Joints
e) Earth Termination and Earth Electrodes

6.1 Materials:

a) The materials of air terminations, down conductors, earth termination etc. of the protective system shall be reliably resistant to corrosion or be adequately protected against corrosion. The material shall be one of the following as specified.
   i) **Galvanised Steel:** Steel thoroughly protected against corrosion by a zinc coating shall be used.
b) Aluminium should not be used underground or in direct contact with walls.
c) All air terminations shall be of GI and all down conductors shall be of GI or aluminium except where the atmospheric conditions necessitate the use of copper or copper clad steel for air terminations and down conductors.

d) The recommended shape and minimum sizes of conductors for use above and below ground as per below tables respectively:

Shapes and minimum sizes of conductors for use above ground:

Sl. No	Material and Shape	Minimum Size
1.	Round copper wire or copper clad steel wire	6mm diameter
2.	Stranded copper wire	50 sqmm or (7/3.00 mm dia)
3.	Copper strip	20mm x 3mm
4.	Galvanized Iron Strip	20mm x 3mm
5.	Round Aluminium Wire	8mm diameter
6.	Aluminium Strip	25mm x 3mm

Shapes and minimum sizes of conductors for use below ground

Sl. No	Material and Shape	Minimum Size
1.	Round copper wire or copper clad steel wire	8mm diameter
2.	Copper strip	32mm x 6mm
3.	Round Aluminium Wire	10mm x 6mm
4.	Galvanized Iron Strip	32mm x 6mm

6.2 Layout:

The system design and layout shall be done in accordance with IS: 2309-1989 and specified in the tender documents.

6.2.1 Air Terminations:

a) Air termination networks may consist of vertical or horizontal conductors or combinations of both. For the purpose of lightning protection, the vertical and horizontal conductors are considered equivalent and the use of pointed air terminations or vertical final is, therefore, not regarded as essential.

b) A vertical air termination, where provided, need not have more than one point and shall project at least 30cm, above the object, salient point or network on which it is fixed.

c) For a flat roof, horizontal air termination along the outer perimeter of the roof shall be used. For a roof of larger area a network of parallel horizontal conductors shall be installed. No part of the roof should be more than 9m from the nearest horizontal protective conductor.

d) Horizontal air terminations should be carried along the contours such as ridges, parapets and edges of flat roofs and where necessary over flat surfaces in such a way as to join each air termination to the rest and should themselves form a closed network.

e) All metallic projections including reinforcement on or above the main surface of the roof which are connected to the general mass of the earth, should be bonded and form a part of the air termination network.

f) If portions of a structure vary considerably in height, any necessary air terminations or air termination network for the lower portions should be bonded to the down conductors of the taller portions, in addition to their own down conductors.

6.2.2 Down Conductors:

The number and spacing down conductors shall be as specified or as directed by the Engineer-in-Charge.

6.2.3 Routing:

a) A down conductor should follow the most direct path possible between the air terminal network and the earth termination network. Where more than one down conductor is used, the conductors should be arranged as evenly as practicable around the outside walls of the structures.

b) The walls of light wells may be used for fixing down conductor, but lift shafts should not be used for this purpose.

c) Metal pipes leading rainwater from the roof to the ground may be connected to the down conductors, but cannot replace them, such connections should have disconnecting joints.

d) In addition on the routing of the down conductor, its accessibility for inspection, testing and maintenance should be taken them, such connections should have disconnecting joints.

6.3 Installation:

6.3.1 General:

a) The entire lightning protective system should be mechanically strong to withstand the mechanical forces produced in the even of a lightning strike.
b) Conductors shall be securely attached to the building or other object to the protected by fasteners which shall be substantial in construction, not subject to breakage and shall be galvanized steel or other suitable materials, with suitable precautions to avoid corrosion.
c) The lightning conductors shall be secured not more than 1.2m apart for horizontal run and 1m for vertical run.

6.3.2 Air Terminations:

All air terminals shall be effectively secured against overturning either by attachment to the object to be protected or by means of substantial bracings and fixings which shall be permanently and rigidly attached to the building. The method and nature of the fixings should be simple, solid and permanent, due attention given to the climatic conditions and possible corrosion.

6.3.3 Down Conductors:

a) The down conductor system must where practicable be directly routed from the air termination to the earth termination network and as far as possible be symmetrically placed around the outside walls of the structure starting form the corners. In all cases consideration to side flashing must always be given.
b) Practical reasons may not sometimes allow the most direct route to be followed. While sharp bends, such as arise at the end of roof are in-escapable (and hence permissible), re-entrant loops in a conductor can produce high inductive voltage drops so that the lightning discharge may ump across the open side of a loop. As a rough guide, this risk may arise when the length of the conductor forming the loop exceeds 8 times width of the open side of the loop.
c) When large re-entrant loops as defined above cannot be avoided, such as in the case of some cornices or parapets, the conductors should be arranged in such a way that the distance across the open side of a loop complies with the requirement indicated above. Alternatively, such cornices or parapets should be provided with holes through which the conductor can pass freely.

6.3.4 Joints to prevent side flashing:

Any metal in or forming a part of the structure or any building services having metallic parts which are in contact with the general mass of the earth should be either isolated from or bonded to the down conductor. This also applies to all exposed large metal items having any dimension greater than 2m whether connected to the earth or not.

6.3.5 Joints and Bonds:

6.3.5.1 Joints

a) A lightning protective system should have as few joints as possible.
b) Joints should be mechanically and electrically effective, for example, clamped, screwed, bolted, crimped, riveted or welded.
c) With overlapping joints, the length of the overlap should not be less than 20mm for all types of conductors.
d) Contact surfaces should first be cleaned and then inhibited from oxidation with a suitable non-corrosive compound.

e) Joints of dissimilar metals should be protected against corrosion or erosion from the elements or the environment and should present an adequate contact area.

6.3.5.2 Bonds:

a) Bonds have to join a variety of metallic parts of different shapes and composition and cannot therefore be of a standard form.
b) There is the constant problem of corrosion and careful attention must be given to the metals involved i.e. the metal from which the bond is made and those of the items being bonded.
c) The bond must be mechanically and electrically effective and protected from corrosion in and erosion by the operating environment.
d) External metal on or forming part of structure may have to discharge the full lightning current and is bond to the lightning protective system should have a cross sectional area not less than that employed for the main conductors.
e) Structures supporting overhead electric supply, telephone and other lines must not be bonded to lightning protective system without the permission of the appropriate authority.
f) Gas pipe in no case shall be bonded to the lightning protective earth termination system.

6.3.6 Tests Joints:

Each down conductor should be provided with a test joint in such a position that while not inviting unauthorized interference, it is convenient for use when testing.

7 MAIN LT PANELS/DISTRIBUTION PANELS & LT SWITCHGEAR

7.1 Main LT Panels/Distribution Panels:

This chapter covers supply/erection/testing and commissioning of TTA Panels:-

a) For each equipment, required IP rating and short circuit rating capacity will be specified. Governing BIS also will be specified.
b) All the equipment will be factory fabricated in an approved factory having modern fabrication and testing process.
c) It shall have Nine tank pretreatment process comprising of Solvent/ Alkaline Degreasing, Water Rinsing, De- Rusting, Water Rinsing, Passivation, Phosphating, Water Rinsing, Activation and Drying.
d) The powder coating shall be as per IS: 13871 (1993) latest as on date having thickness 70-80 micron for Indoor enclosure and 100-120 micron for Outdoor enclosure or as specified in BOQ whichever is high.
e) The powder paint will be subjected to oven-heated process.
f) All panels will be provided with suitable gasket.

7.1.1 Reference Codes & Standards:

The reference codes and standards for Panel Assemblies shall be followed as mentioned below:

S.No.	Description	Reference Standard
1	**For TTA* Panel**	
i.	Low Voltage Switchgear Assemblies	IEC 61439- 1&2
ii.	Low Voltage Switchgear & Control Gear	IEC 61439- 1&2
2	Degree of Protection	IEC 60529
3	Mechanical Impact	IEC 62262
4	Internal Arc	IEC 61641

* The TTA Panels are defined under IS: 8623 and IEC 61439, the higher and the latest code of practice shall only be followed.

7.1.2 Material & Construction:

a) Cubicle Panel shall be floor mounted (on a base frame as specified in BOQ) or wall mounted with hooks. The design shall include all provisions for safety of operating and maintenance personnel.
b) The degree of protection for panel assemblies shall be IP: 52 for Indoor Enclosures and IP:55 for Outdoor Enclosures or as specified in BOQ.
c) The Panel shall be compartmentalized form 3b bolted type having space and arrangement for incoming cable/ bus-trunking, incoming switchgear/ switchgears, bus coupler, insulated and properly supported compartmentalized switchgear, bus bar supports, joint shrouds, cable alleys of suitable size for cabling routing, support and terminations, interconnection between bus bars and switchgear with auxiliary bus bars/ insulated conductors/ strips etc.
d) The panel enclosure shall be fabricated out of CRCA sheet steel of 2.0 mm thickness or as specified in BOQ whichever higher and gland plates shall be of 3.0mm thickness.
e) The framework may be angle iron/ channel/ bolted type construction.
f) All rear doors shall be hinged type for all the rear accessible type boards and outdoor panels.
g) Suitable pressure relief devices shall be provided to minimize danger to operator during internal fault conditions.
h) Internal Arc capacity should be 50kA for 0.1 sec for PTTA panels.
i) The ACB used for Incoming or bus-coupler shall be arranged in single tier formation only.
j) All switchboards having incomer equal or greater to 630A and Main LT Panels shall be readily extensible on both sides by addition of vertical/ horizontal section after removal of the end covers.
k) The overall height of the switch boards shall be limited to 2450mm or less as per manufacturer design. The maximum and minimum operational height shall be restricted between 1800mm to 300mm respectively from finished floor level.
l) Before assembling, all joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity of all joints.
m) All screws, bolts, washers shall be zinc plated and suitable grade nuts and bolts shall be used for bus bar connections.
n) Arrangement for Incoming/ Outgoing cable termination/ Terminal Block:

(i) Cable entries shall be provided either from the rear or from the front through cable alleys of suitable size.
(ii) Removable gland plate to be provided for each cable entry.
(iii) Incoming termination shall be suitable for receiving bus trunking / cables as per SLD. Cable terminations in case of bus bar shall be of tinned copper.
(iv) Cable support arrangement to be provided inside cable alley so that cables are neatly arranged and fixed.
(v) From each outgoing switchgear, up to 63A PVC insulated Cu flexible conductor, of equal of one rating higher capacity of the respective breaker, shall be used and above 63A bus bars of same material as of main bus bar of the system shall be used.

(vi) It is desirable that cables are not terminated directly to switchgear, but terminated through proper terminal blocks usually equal or one rating higher of the rating of the breaker.

7.1.3 Specification of cable Terminal Block:

a) Terminal block of reputed make shall be used. The housing material shall be polyamide having unbreakable and fire retardant characteristic. All the metal parts shall be made up of copper alloy including the screws. Mounting shall be 'Din' or 'G-rail' type. Screws shall be self-captive type. No protection cover is required and the block should be touch proof.

7.1.4 Bus bars/ Supports/ Clearances:

a) Bus bar supports insulators shall be class 'F' insulators made of non-hygroscopic, non-combustible, track resistant and high strength FRP/ SMC/ DMC material and shall be of suitable size and spacing to withstand the dynamic stresses due to short circuit currents.
b) The bus bar system may comprise of a system of main/ auxiliary bus bars run in touch proof bus bar alley.
c) The bus bars shall be made of rectangular cross sections of high conductivity & strength of copper or aluminum as specified in BOQ/ SLD and suitable to withstand with the stresses of fault level as specified or equal to the fault rating of the incomer breaker.
d) The copper bus bars shall be of 99.9% purity and aluminum bus bars shall be of Electrolytic grade E91.
e) The current density of bus bars shall be followed as per below table or as specified in BOQ:

S.No.	Description	Current Density of Bus Bar
1	**For Residential Building**	
i.	Copper Bus Bar	2A/ Sqmm
ii.	Aluminum Bus Bar	1A/ Sqmm
2	**For Non- Residential Building**	
i.	Copper Bus Bar	1.6A/ Sqmm
ii.	Aluminum Bus Bar	0.8A/ Sqmm

f) All bus bars shall be provided with Halogen free heat shrinkable colour coded insulated sleeves with RoHS compliance.

g) All connections to individual circuits up to 63A from the bus bar shall be with PVC insulated Cu flexible conductor as per IS 694, of equal or one rating higher capacity of the respective breaker and above 63A, the bus bars of same material as of main bus bar of the system shall be used.

h) Bus bar nomenclature shall be as defined in below table:

S.No.	Description	To be read as
1	SP	Single Phase
2	SPN	Single Phase and Neutral (Neutral shall be Half of Phase Capacity)
3	DP	Double Phase (Neutral shall be Equal of Phase Capacity)
4	TP	Three Phase
5	TPN	Three Phase and Neutral (Neutral shall be Half of Phase Capacity)
6	TP+2N	Three Phase and Neutral (Neutral shall be 200% of Phase Capacity)
7	4P	Three Phase and Neutral (Neutral shall be 100% of Phase Capacity)

7.1.5 Earthing:

a) All electrical Panels shall have two nos. common G.I. earth bar of 50X6mm for the panels having incomer fault of 50kA and rest all with 32X6mm or as specified conductor throughout of the panel length as per the fault kA rating of main Incomer, at the rear and for wall mounted panel with 2Nos. earth stud at top one at each side.

b) Dedicated copper bus bar strip of 1x32x6 Sqmm 0.5 meter long with 12-15 holes for termination 4 to 25sqmm copper wires in cable Alley mount on 2Nos. Insulators shall be provided in UPS Output Panel only.
c) All hinged doors and compartment shall be earthed with minimum 2.5sqmm cu wire in spiral form for more flexibility.

7.1.6 Requirements for TTA:

a) Main distribution boards shall be assembled only by a franchisee of the original manufacturer and approved by the consultant. The certificate copy issued by original manufacturer shall be attached with quotation document for review & acceptance. All major components like enclosures, switchgear components and bus bar supports shall be supplied by OEM manufacturer to franchisee assembler.
b) Panel builder / Assembler / Licensee partner shall have a minimum experience of 10years in the field of switchgear assembly.
c) The main distribution boards shall comply and perform satisfactorily at special design conditions as minimum: Ambient Temperature @ 45ºC & Relative Humidity @ 95% (At 55ºC).
d) All TTA panels shall have sheet steel hinged doors for all compartments and provided with duly interlocked with the breaker for "ON" & "OFF" positions.
e) The external covers provided should have been subjected to minimum mechanical impact of IK09 as per IEC to ensure specified degree of protection.
f) Unless specified / approved otherwise, enclosure system, the switching devices and other components used for assembly of the main distribution boards shall be from original manufacturer. Different manufacturer for the main distribution board enclosure and switching devices will not be accepted / approved.
g) Each panel section (cable compartment) shall be provided with thermostatically controlled panel heater.
h) The Enclosure shall be made out of electro galvanized steel sheets conforming to international specification. Zinc coating shall be provided on the sheets, which shall prevent rust formation during storage and handling for processing, in addition to giving corrosion protection to the finished product.
i) The enclosure system shall be Modular in nature with bolted on construction. Enclosure parts/ kits shall be interchangeable to reduce downtime during modification or maintenance work.
j) The fault level rating of the bus bar system shall be as per the drawings however the minimum short circuit withstand capacity shall be 50KA RMS for 1second.
k) Internal Arc capacity should be 50kA for 0.3 sec or as specified in BOQ whichever higher.
l) The bus bar joints shall be plated or provided with bimetallic washers for dissimilar material. The hardware used at joints shall be as per original manufacturer's recommendation.

7.1.7 Safety Feature and Interlocks:

a) The safety shutter shall be provided in breaker panels, which shall prevent in advertent contact with isolating contacts when breaker is withdrawn from the cradle.
b) Door interlocking shall be provided in each switchgear compartment with a provision of defeat interlock
c) All panel doors shall have provision of padlocking.
d) Insulating barriers shall be provided in all live sections of the panel.
e) There shall be provisions of positive earth connection between fixed and moving portion of the ACB either through connector plug or sliding solid earth mechanism.
f) Earthing bolts shall be provided on the cradle or body of fixed ACB.
g) Arc chute covers shall be provided wherever necessary.
h) In case of draw out type switchgears safety shutters shall be provided to fully cover the live section automatically once the switchgear is being draw out.

i) It shall be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration.
j) There shall be provision for locking the breaker in all three positions.

k) The breaker shall be provided with interlock to prevent the breaker from being withdrawn or replaced except in the fully isolated position.
l) Interlock shall also be provided to prevent the breaker from closing without in service position.
m) Space heater triggered by thermostat shall be provided in cable compartment to avoid moisture.
n) Lamp operated with a door limit switch and a toggle switch shall also be provided in panel compartments along with 6/16A with socket for ease of maintenance.

7.1.8 Microprocessor based Auto Starting/ Auto Load Sharing/ Auto Synchronization:

The auto synchronizing shall be provided as mentioned below and as per BOQ/ SLD/ BOQ.

7.1.8.1 Sequence of operation:

1. Sequence of Operation in Auto Mode

a) Synchronizing panel logic shall be to automatic start Master GENERATOR set (Selected by Microprocessor based generators control and engine management & monitoring package) through cranking relay & close its CB/NIS after verifying frequency and voltage and shall start feeding the essential load.
b) On failure of mains power supply, DG sets shall start (ON) based on demand load available on respective bus before power failure and same shall come on automatically and synchronize on the bus. DG sets shall remain ON depending upon the load monitored on each 11 kV changeover panel and balance DG sets shall stop after their respective cooling cycle. The combined synchronized power should be fed to the incomer bus of 11 kV changeover panel when the generator output reaches 90% of its rated voltage and frequency. As load increases beyond 75% on DG set which is running, other generator will start and synchronize on the same bus. Similarly as load increases further other generators shall start automatically and synchronize on the same bus.
c) As the load increases or decreases accordingly switching ON and OFF of the generator on the synchronizing bus shall continue with the help of microprocessor based generator control package.
d) Auto synchronizing system shall verify the phase angle of all the sets and also compensate for CB closing time by initiating closing of the breaker ahead of the actual predictable synchronism thereby ensuring a phase difference of zero degree. The breaker closing command shall not be given at a phase angle difference of + 4% in any circumstances.
e) The synchronizing system shall operate the generator ISOCHRONOUS mode by setting Droop to Zero. The system shall have a direct analogue interface with the AVR & Governor for direct bias control. No motorized potentiometers shall be acceptable.
f) Failure of any synchronizing module shall not disturb the synchronizing of other generator.
g) Failure of generator control package shall not affect the synchronizing system which shall be independent of each other.
h) System shall also monitor the slip frequency and the Beat Voltage of the machine or system.
i) NIS of master generator shall remain in circuit. In the event of shutting OFF of First Set, NIS of any other generator shall close first before tripping NIS of first set. It shall be possible to alter sequence of generator starting through, manual selection or through generator control package.
j) Active and reactive power shall be made equal on all the machines automatically with the help of ACTIVE LOAD BALANCING System through Governor Control.
k) In event of set failing to Synchronize, Alarm from annunciator shall invite attention of OPERATOR for manual intervention.
l) LOAD MANAGEMENT SYSTEM shall have output contacts for tripping various loads by field wiring and also trip the VCB of different generator and give ALARM for shutting OFF generator in accordance with predefined parameters to avoid under loading, overloading, cascading effect of tripping and unnecessary FUEL WASTAGE.
m) On the removal of load, generator circuit breaker & Bus Coupler CB's shall be switched OFF in preset sequence with time delays to cover DIPS. Generator shall continue to run for 3 Minutes or predefined after generator CB has been switched OFF.
n) It shall be possible to alter crucial setting / time delays through MAN MACHINE INTERFACE (HMI).
o) All auxiliaries to operate system shall be come ON automatically.
p) Engine start stop control system shall be mounted on the generator panel.

Note:-1000VA on-line single phase input / single phase output (230 V) UPS with 30 minutes battery backup to be provided along with the synchronizing panel.

2. Sequence of Operation in Manual Mode

a) In the manual mode master generator set shall be started by pressing 'Engine Start' Push Button (PB)
b) When Engine starting push button is pressed cranking relay shall be energized and give starting signal to the engine.
c) After full voltage is build up, breaker of the Master generator shall close manually with the help of breaker control switch.
d) When breaker Control switch is turned to 'CLOSE' position, breaker as per following sequence:
   (i) PLC/Main Selector Switch shall be in Manual Mode.
   (ii) Solo/Parallel Selector Switch being in 'Solo' mode.
   (iii) With the conditions mentioned above fulfilled and breaker control switch in 'Close' position, Neutral contactor shall be energized.
   (iv) Closing command to the generator breaker shall be given.
e) In manual mode care shall be taken, to synchronize the follower generator sets with the 'Master' before closing its breaker.
f) For synchronizing the guarantee in manual mode, voltage/frequency raise/low commands shall be given to Alternator/Engine with the help of 'Joy sticks' provided in the Relay/Synchronizing Panel or internally through genset digital controller
g) While synchronizing the generator, manually, all the parameters viz. voltage, frequency and phase rotation shall be monitored with the help of Double voltmeter, Double Frequency Meter and Synchronoscope provided in the Relay/Synchronizing Panel and breaker shall be closed only when all the three parameters are matched properly or internally through genset digital controller.
   (i) Active/Reactive load sharing between all the running sets in manual mode shall be managed by raising/lowering voltage/frequency with the help of joy sticks or internally through genset digital controller.
   (ii) During the parallel operation of Power Generating sets in 'Manual Mode', Neutral contactor of only master generator shall close. This shall be assured by inter locking the neutral contactors of all the generator.

7.1.8.2 Automatic Generator Sequencing:

Automatic starts & stop gensets based on load or demand load bus. Configurable load bus demand start/stop levels & timers. Online engine priority sequence configurability from any synchronizing unit or PC to equalize run time of DG all DG sets.

7.1.8.3 Control System:

a) All the electrical parameters are monitored centrally through intelligent processing. All the electrical data is brought to the PLC & then PLC controls the complete Synchronizing, Load Control & Management system. Control, monitoring and data functions shall be provided by.
b) There are two options provided for control, monitoring & data logging functions graphic display terminal along with laser printer.
c) The minimum PC requirements shall be Windows 10 OS, Intel Core i7, 6th Gen, 2GB Graphics,52 X CD ROM, MM Speakers, LAN (Ethernet Port), 2 x USB ports, 2 x COM ports, 1 x Parallel port. SMPS with other standard accessories, 1 No. 32 inch colour PC (latest version), A-4 size Laser Colour Printer and all License version software.

7.1.9 Site Visit and Documentation:

The manufacturer shall visit the site to review the site conditions and shall submit a report complying following points:
a) Possible Height & Width for the Panel.

b) Back access is possible or not.
c) Cable entry will be possible from bottom or from top.
d) If cable entry from bottom, stand will be required or not.
e) If panel is going to be wall mounted, the wall is available or not.
f) Path for movement of transportation of panel is possible or not i.e length, width etc. and the transportation sections shall be designed according.
g) Sufficient space available at front & back after door opening.
h) Sufficient height available above panel for cable drop.

7.1.10 Minimum Documentation for GA submission:

The manufacturer shall provide following documentation along with the GA drawings:

a) General Note and considerations for Construction of the Panels having sheets thickness, IP, bus bar clearance, bus bar size, rating & density with material, base frame, control wiring details etc.
b) Schematic Diagram of the panels
c) BOM with selected make with all component's model no.
d) Bus bar orientation
e) Top/ Bottom and front/ Back/ Side views as applicable.
f) Detail of interconnection bus bar/ cable between the incoming breaker and main bus bar and main bus bar and outgoing breakers.
g) Discrimination chart for all networks.
h) Following certificates shall be submitted along with the GA drawings
(i) Copies of CPRI certification upto 70kA withstand capacity @ 1sec for PTTA Panels.
(ii) Copy of TTA Test certificates shall be submitted by the contractor of selected switchgear manufacturer from the list of approved makes only.
(iii) Certificate for Bus Bar purity, density and RoHS Compliance.
(iv) Certificate for No de-rating up to ambient temp. 50ºC for all breakers and selected components.

7.1.11 Factory Tests:

When all the panels are ready as per the approved GA drawings, the panel manufacturer invites the consultant for panel inspection. The following tests shall be performed at the manufacturer's factory unit.

a) Visual check which covers measurement of dimension, location, number and type of devices etc.
b) Checking as per Bill of Material and Approved GA drawings
c) Functional Check which covers operation of various feeders as per approved GA drawings
d) Operation check for every control function
e) Insulation resistance test and value measurement on power and control circuits before and after high voltage withstand test.
f) High voltage test on power and control circuit as per IS 8623.
g) MV Megger test.

7.1.12 Type Tests for TTA Panels:

The main distribution board and the components as applicable shall be type tested in accordance with the IEC standards to verify the specified fault level withstand capacity from a reputed and approved type testing laboratory and certified by an competent authority.

The following type tests as specified in IEC 61439-1standards shall be carried out on assembly at recognized test laboratories and certificates shall be provided for each type test:

a) Verification of temperature-rise limits (IEC cl.10.10)
b) Verification of Dielectric properties (IEC cl. 10.9)
c) Verification of short- circuit withstand strength (IEC cl. 10.11)

d) Verification of the effectiveness of the protective circuit (IEC cl. 10.5)
e) Verification of clearances and creep age distances (IEC cl. 10.4)
f) Verification of mechanical operation (IEC cl. 10.13)
g) Verification of the degree of protection (IEC cl. 10.3)
h) Verification of mechanical impact (IEC cl. 10.2)

7.1.13 Packing:

The packing shall be accordance with the bidder's standard practice but he shall give full particulars of packing for the approval of the purchaser.
All the parts shall be adequately marked to facilitate field erection.
Boxes and creates shall be marked with the contact numbers and shall have a packing list enclosed showing the parts contained therein.

7.1.14 Installation:

a) The installation work shall cover assembly of various sections of the panels lining up, grouting the units etc. In case of multiple panel switch boards after connecting up the bus bars etc. all joints shall be insulated with necessary insulation tape or approved insulation compound. A common earth bar shall be of appropriate rating as per fault or as specified shall run inside at the back of switch panel connecting all the sections for connecting to frame earth system. All protection and other small wirings for indication etc. shall be completed before calibration and commissioning checks are commenced. All relays, meters etc. shall be mounted and connected with appropriate wiring.
b) The Rising Mains, bus trunking or wall mounted panels shall be supported such that its weight does not come to the power cable or earthing terminals.
c) All rising mains/ bus trunking enclosures hanged from slab shall be suspended at a uniform height of minimum 2400mm above finished floor level. The layout got approved from the Engineer-in-Charge before erection.
d) If rising mains/ bus trunking is hanged from slab, each section of the enclosure shall be suspended from the ceiling slab with suitable MS suspenders or GI threaded rods and support angles/ channels. The runs shall be neat and route shall be as per the design or as directed by Engineer-in-Charge.
e) A connector assembly for plug in box shall be supplied loose with each section of the rising mains/ bus trunking enclosures for coupling two sections and it shall comprises a rubber locating ring. Bus bar insulating tube and a connector insulating tube.

7.1.15 Testing and Commissioning:

Commissioning checks and tests shall include all wiring checks and checking up of all connections. Following shall be performed at site:

a) Relay/ meters adjustment/ setting shall be done before commissioning.
b) Tightening of all nuts and bolts.
c) Closing of any left out holes to ensure the panel is insect proof and IP compliances.
d) Operational check of all breakers, Contactors, protection devices and instruments
e) Lubrication of all moving parts.
f) Interlock function check
g) Insulation test: when measured with 500V Megger the insulation resistance shall not be less than 100 Mega Ohm.
h) Trip tests and protection gear test.
i) Earth Test

7.1.16 Handing Over Document:

The contractor shall submit a handing over document consisting of following:

a) Operational & maintenance manual.
b) Installation guidelines of all products' data sheets come along with product.
c) As built of GA drawings with wiring diagram and selected product part codes

7.2 LT Switchgears:

7.2.1 Standards and Codes:

The latest amended up to date Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 2003 and Indian Electricity Rules 1956 as amended up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

7.2.2 Air Circuit Breaker:

The ACB shall conform to the requirements of IS/IEC 60947-2 and shall be type tested & certified for compliance to standards from–CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 433 V, 3 phase, 50 Hz supply system. Air Circuit Breakers shall be with moulded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" "CIRCUIT HEALTHY" "SPRINK CHARGE "indications.

ACB should be able to carry Rated current as required in the SLD at the yearly maximum ambient temperature applicable for 50 degree centigrade and as per site condition whichever is higher.

ACB should have an operational designed voltage of 690 V for Ics=100% Icu for Icw=1 Sec.

The ACB shall be 3/4 pole with modular construction, draw out, manually or electrically operated version as specified in SLD. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity(Icu) and short circuit withstand values(Icw).

Circuit breakers shall be designed to 'close' and `trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Mechanical Contact wear indicator shall be mounted directly on the moving contacts to indicate the degree of erosion of the contacts. The ACB shall be provided with a door interlock i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breakers shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall open after the main contacts open. Minimum 4 NO and 4 NC auxiliary contacts or as per BOQ requirement w.r.t Manufacturer shall be provided on each breaker. Rated insulation voltage shall be 1000 volts AC.

7.2.2.1 Cradle:

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on Pin & Cam type/steel balls/rollers and not on flat surfaces.
There shall be 3 distinct and separate position of the circuit breaker on the cradle. Racking Interlock in Connected/Test/Disconnected Position

- Connected Position: Main isolating contacts & control contacts of the breaker are Engaged
- Test Position: Main isolating contacts are isolated but control contacts are still engaged

- Isolated Position: Both main isolating & control contacts of the breaker are isolated
- There shall be provision for locking the breaker in any or all of the first three positions.
- The following safety features shall be incorporated:-

a) Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.
b) Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.
c) All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.
d) All Switchgear module front covers shall have provision for locking.
e) Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.
f) Actual Contact Inspection should be possible by removing Breaker from the panel – with mechanism connected to moving contacts of ACB.

7.2.2.2 Protections:

The breaker should be equipped within built battery backup microprocessor LCD display based release to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following five zones:

- Long time protection.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection.
- Neutral protection for 4 pole ACBs.

The protection release shall have following features and settings:

a. True RMS Sensing:

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current.

b. Thermal Memory:

When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.

c. Defined time-current characteristics:

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

d. Trip Indication:

Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis. ACB should display last 20 trip history with date time stamping.

e. The release shall meet the EMI / EMC requirements.

f. The setting range of release shall confirm to IEC- 60947 and its applicable sub-parts. All ACBs shall have over temperature protection of release.

All Incomer ACBs shall have temperature rise monitoring at cradle terminals and display thru protection release, LED/LCD display showing all Power & Energy Parameters (Currents, %loading, Voltages, Frequency, PF, Power & Energy (active, reactive & apparent) etc. All incomerACBs shall have following additional protections other than mentioned above:-

- Under and over voltage
- Under and over frequency
- Restricted Earth Fault protection
- Trip Circuit supervision with PS class CT's.
- Undercurrent, (for DG set only)
- Reverse power (for DG set only)

- Phase sequence reversal
- Load shedding and reconnection thru programmable contacts.

Release should have LCD display for Power parameters.

- Release should be able to capture short circuit current on which ACB has tripped. The trip and alarm shall be stored in memory with the date & time stamping along with type of fault and alarm.
- Release should be self-powered.
- Integral Test facility to test healthiness of release and the trip circuitry shall be provided on the Release.
- Programmable digital contact shall be provided with possibility to configure for pre alarm like over load, over temperature etc, and trip functions like OL/SC/EF/OT etc.

7.2.2.3 Safety Features:

- The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
- The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.
- Draw out breakers should not close unless in distinctservice/Test/Isolated positions.
- The insulation material used shall conform to Glow wire test as per
- IEC60695.
- The ACB shall provide in built electrical and mechanical anti-pumping.

7.2.3 Moulded Case Circuit Breaker (MCCB):

7.2.3.1 General:

- Moulded-Case Circuit Breakers (MCCB) shall comply with IEC 60947-1&2 standards.
- Earth Leakage Relay (30-3000mA) with CBCT shall be used for all outgoings MCCB.
- Earth Fault shall be provided for all incoming MCCB.
- MCCB shall be of category A with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) on all the ratings.
- MCCB shall have designed operational voltage upto690 V AC (50/60 Hz).
- MCCB shall have a rated insulation voltage of 690 V AC (50/60 Hz)
- Indication lamp ON, OFF, TRIP shall be provided incomer MCCBs and ACB.
- MCCB must be available in Microprocessor (250A and above) / Thermal Magnetic (Up to 200 Amp.) type release.
- All MCCB should be fully rated up to 50 Deg C.
- All thermal magnetic MCCBs up to 160A shall be adjustable thermal and fixed magnetic type and 200A shall be adjustable thermal and adjustable magnetic type (Ir = 0.8 x In to 1.0).
- For microprocessor shall have following characteristics:-
- LI : (Ir=0.4 to 1xln, Ii=1.5to 8xln)
- LSI : (Ir=0.4 to 1xln, Isd=1.5to 8xln)
- MCCBs shall be permissible for mounting in all 3 axes (Vertical Wall, Laterally Rotated Walland Ceiling& Floor mounting) without any adverse effect on electrical performance. It shall have line load reversibility.

7.2.3.2 Construction & Operation:

- For maximum safety, the power contacts shall be insulated in an enclosure made of a thermosetting material from other functions such as the operating mechanism, the case, the trip unit and auxiliaries.
- MCCBs shall be actuated by a toggle or handle that clearly indicates the three positions: ON, OFF and TRIPPED.

- The operating mechanism shall be designed such that the toggle or handle can only be in OFF position (O) if the power contacts are all actually separated & in OFF position, the toggle or handle shall indicate the isolation position.
- MCCBs shall be equipped with a “push to trip” button in front to test operation and the opening of the poles.
- The MCCB should be having a trip-free mechanism that ensures the trip process is not prevented even if the operating mechanism is blocked or manually held in the "ON” position.
- The Microprocessor Release MCCBs should be equipped with non-saturable type CTs for reliable & accurate protection.
- All microprocessor based MCCBs should have display with battery back-up.
- All microprocessor based MCCBs should have precise current setting in one step.

7.2.3.3 Current Limit & Selectivity:

- MCCBs shall be Current Limiting type.
- MCCBs, the current ratings of which are identical with the ratings of their trip units, shall ensure selectivity in rated current interval 1:1.6
- -MCCBs shall be equipped with a test facility of the Release by a hand-held device.

7.2.3.4 Accessories:

- MCCBs shall have uniform Internal Accessories platform across the range
- MCCBs Door Mounted Extendible Rotary Handle shall have an option of Illumination Kit to indicate three stable mechanism positions (ON, OFF and TRIPPED).
- MCCBs with TMTU Release should have provision for separate Short Circuit Signal facility.
- MCCBs shall be snap fit type to enable safe on-site installation of auxiliaries, voltage releases, signal contacts etc.
- MCCBs should have symbols engraved in the lid of the accessories compartment to indicate possible mounting position of internal accessories.
- The addition of a motor module or manual rotary handle etc. shall not block device settings.
- MCCB shall be equipped with Phase barrier, tinned copper spreaders.

7.2.3.5 Communications:

- All incomers ACBs & MCCBs in main LT panel and distribution panel shall be BMS compatible in open protocol.

7.2.4 Moulded Case Circuit Breaker (MCB):

Miniature Circuit Breaker shall comply with IS/IEC 60898-1:2002& EN 60947-2 or IEC-60947-2. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

7.2.5 Meter:

The digital meters shall conform in all respects to International standards –IEC 62053-21-22 or the relevant Indian standards, RoHs compliance with latest amendments thereof.

- All voltmeters and indicating lamps shall be through Control MCB's.
- Meters and indicating instruments shall be flush type.
- All CT's connection for meters shall be through Test Terminal Block (TTB).
- CT ratio and burdens shall be according to connected instrument and load.

Digital Multi-Function meter shall be provided in all incomers in main LT panels and distribution panels as shown in SLD, having following characteristics:-

- Digital Electronic multi-function meter with RS-485 port with THD with individual harmonics up-to 31st order and THDi to measure and display the following electrical parameters:-
- Total active energy(KWH/MWH),
- Maximum demand(KVA/MVA)(KW/MW),
- Maximum demand reset count,
- Instantaneous power factor,
- High/Low recording of VLL, VNL, A, Hz, PF, Var, with time stamp.
- K factor V & A to keep check on the losses due to harmonic load current and their effects of transformer heating.
- Load Manager with Demand monitoring and RTC based demand manager.
- Export/Import Net monitoring of WH, VAH, VArh, inductive/capacitive load hours.
- Auto Scaling Capability in variance of Kilo, Mega, Giga.
- Positive energy accumulation even with CT polarity reversal with reverse lock programmable.
- Byte order option-Field Programmable float/Little Endian/Big Endian data formats.

7.2.5.1 General Requirements:

- CT polarity correction should be possible through Energy Meter for each phase.
- Import/ Export measurement for KWH/ KVARH is required.
- The current inputs shall be configurable at site for measuring x/5/1 A current transformers
- The meters shall be suitable for operation with AC auxiliary power and shall have wide tolerance band of 70V to 300V, 40-70Hz
- The multifunction meters shall have backlit LCD display with power saving mode/ adjustable contrast.

7.2.6 Current Transformer:

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5/ 1 amps secondary for operation of associated metering. The CTs shall confirm to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class as per SLD.

7.2.7 Residual Current Circuit Breaker (RCCB):

7.2.7.1 System of Operation:

Residual Current Circuit Breaker shall confirm to IEC 61008.RCCB shall work on the principle of core balance transformer. The incoming shall pass through the torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB

shall be current operated independent of the line voltage; current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.
RCCBs should have a rated conditional short-circuit current of 10 kA.

7.2.7.2 Mechanical Operation:

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing /opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

7.2.7.3 Neutral Advance Feature:

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact first before the phases; and at the time of opening, the neutral shall breaks last after allowing the phases to open first. This is an important safety feature, which is also required by regulations.

7.2.7.4 Testing Provision:

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB.

7.2.7.5 Switchgear & Protection:

Incomer switchgear shall be TP breaker appropriate rating (minimum 1.8 times the normal current to take care of inrush switching current). Suitable contactor for each step shall be used and must be capable of capacitor switching duty at each step for short circuit protection.

Busbars shall be suitably colour coded and must be mounted on appropriate insulator supports. Power cables used shall have superior mechanical, electrical and thermal properties, and shall have the capability to continuously operate at very high temperatures up to 125 degC.

Internal wiring between main bus-bars, breaker, contactor and capacitors shall be made with 1100 V grade, PVC insulated, copper conductor cable of appropriate size, by using suitable copper crimping terminal ends etc.

Suitable bus links for input supply cable termination shall be provided.

7.2.7.6 Control Circuit & General Protection:

The control circuit shall be duly protected by using suitable rating MCB.

An emergency stop push button shall be provided to trip the entire system (22.5 mm dia, mushroom type, press to stop and turn to reset).

Wiring of the control circuit shall be done by using 1.5 sq.mm, 1100 V grade, PVC insulated, multi-stranded copper control wire.

Inspection terminal strip, number ferruling, labeling etc. shall be provided.

440 V caution board on the panel shall be provided.

8 LIGHT FIXTURES AND FAN

Note: - All the components, materials, accessories of Light Fixtures shall be supplied & designed as per -30o C ambient temperature and 3525 meters MSL. If the specification of items will increase as per the altitude above, the feasible specification shall be followed without cost increase.

The contractor shall submit LM 79 report of the LED Luminaries& LM 80 report from LED manufacture before fixture supplied at site. Driver of the LED fitting should by Potted. The make of LED used shall be Osram/Cree/Nichia/Philips/Lumiled.

All lighting fixtures must comply the following specifications to meet out the requirement according to relevant CPWD specification/IS code/NBC-2016/ECBC-2017 whichever is high.

- Lumens >certain value as specified in drawings
- Efficacy >100 for indoor lighting fixtures and >120 for highway and outdoor luminaries.
- CRI >80 for indoor lighting and 70 for external lighting
- Power Factor >0.95
- THD <10
- Surge Protection - 2.50KV for indoor and 5 KV for outdoor lighting fixtures.
- Operating voltage - 150-270 volt.
- Useful life of LED's - 50000 hours @ L70

9 EARTHING

This chapter covers the essential requirements of earthing system components and their installation. For details not covered in these specifications IS Code of Practice on Earthing (IS: 3043-1987) shall be referred to.

9.1 Application:

a) The electrical distribution system in the Department is with earthed neutral (i.e. neutral earthed at the transformer/generator end). In addition to the neutral earthing, provision is made of earthing the metallic body of equipment and non-current carrying metallic components in the sub-station as well as in the internal/external electrical installations.
b) Earthing system is also required for lightning protection, computer installations and hospital operation theaters etc. for functional reasons.
c) Earthing requirements are laid done in Indian Electricity Rules, 1956, as amended from time to time and in the Regulations of the Electricity Supply Authority concerned. These shall be complied with.
d) Application for Internal E.I:
(i) The Every sub-main will have earth continuity conductor to run along with sub-main wiring. In case of 3-phase sub-main wiring two earth continuity conductors shall be provided.
(ii) Every circuit will have its earth continuity conductor to run along with circuit wiring. N case of 3-phase circuit two earth continuity conductors shall be provided.
(iii) Looping of earth is allowed only in case of point wiring.
(iv) When 2/3 power outlets are looped to one circuit, earth looping of these outlets is permissible.

9.2 Types of Electrodes & Material:

9.2.1 Earth Electrodes:

The type of earth electrode shall be any of the following as specified: Plate Earth Electrode

9.2.2 Electrodes Materials and dimensions:

a) Pipe electrodes shall be cut tapered at the bottom and provided with holes of 12mm dia, drilled not less than 7.5 cm from each other upto 2m of length from the bottom.
b) The length of the buried strip or conductor earth electrode shall be not less than 15m. This length shall suitably be increased if necessary, on the basis of the information available about soil resistance so that the required earth resistance is obtained. Prior approval of the Engineer-in-Charge shall be taken for any such increase in length.
c) All hardware items used for connecting the earthing conductor with the electrode shall be of GI in the case of GI pipe and GI plate earth electrodes and forged tinned brass in case of copper plate electrodes.

9.2.3 Earthing Conductor & Sizes:

a) The earthing conductor (protective conductor from earth electrode up to the main earthing terminal/earth bus as the case may be) shall be of the same material as the electrode viz. GI or copper and in the form of wire or strip as specified.

b) The size of earthing conductor shall be as specified in Drawing/ SLD/ BOQ but this shall not be less than the following:
   (i) 4mm dia (8SWG) copper wire.
   (ii) 8SWG GI wire
   (iii) 25mm x 3mm in case of GI strip
   (iv) 20mm x 3mm in case of Cu Strip

c) Earthing conductor larger than the following sectional areas need not be used unless otherwise specified:
   (i) 150 sq. mm in case of GI
   (ii) 100 sq. mm in case of Cu

d) The sizes and cross sections of conductors shall be followed as per table below:

S.No.	Type of Electrode	Material	Size
1	Plate	GI	600mm x 600mm x 6mm thick
		Copper	600mm x 600mm x 3mm thick

Note: Galvanized of GI items shall conform to Class – IV of IS: 4736-1986.

9.2.4 Earth Continuity/ Loop Earthing Conductor & Sizes:

The material and size of protective conductors shall be as per below table or as specified in Drawing/ SLD/ BOQ whichever higher:

S.No.	Size of Phase Conductor	Size of Earth Conductor
1	Upto 6 sqmm	6 sqmm
2	Above 6 sqmm upto 16 sqmm	6 sqmm
3	Above 16 sqmm	Half of the phase conductor

9.2.5 Location for Earth Electrodes:

a) Normally an earth electrode shall not be located closer than 1.5m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the building in such cases, electrodes may be located further away from the building with the prior approval of the Engineer-in-Charge.

b) The location of the earth electrode will be such that the soil has a reasonable chance of remaining moist as far as possible. Entrances, pavements and roadways should be avoided for locating earth electrodes.

9.3 Installation:

9.3.1 Electrodes:

a) Artificial Treatment of Soil:

(i) When artificial treatment of soil is to be resorted to, the same shall be specified in the schedule of work. The electrode shall be surrounded by charcoal/coke and salt.

b) Watering Arrangement:

(i) In the case of plate earth electrodes, a watering pipe 20mm dia. Medium class pipe shall be provided and attached to the electrodes. A funnel with mesh shall be provided on the top of this pipe for watering the earth.

(ii) In the case of pipe electrodes, a 40mm x 20mm reducer shall be used for fixing the funnel with mesh.

(iii) The watering funnel attachment shall be housed in a masonry enclosure of the size not less than 30cm x 30cm x 30cm.
(iv) A cast iron/MS from with MS cover, 6mm thick and having locking arrangement shall be suitably embedded in the masonry enclosure.

9.3.2 Earthing Conductor (Main Earthing Lead):

a) In the case of plate earth electrode, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.
b) In the case of pipe earth electrode, wire type earthing conductor shall be secured using a through bolt, nuts and washers and terminating socket.

c) A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth electrode. Galvanized "C" shaped strips, bolts, washers, nuts and check nuts of adequate size shall be used for the purpose.
d) The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class, 15mm dia. GI pipe in the case of wire and by 40mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30cm deep (to be increased to 60cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.
e) The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by:
(i) Soldered on preferably crimped lug, bolt, nut and washer in the case of wire.
(ii) Bolt, nut and washer in case of strip conductor.

In the case of substations or alternators, the termination shall be made on the earthing terminal of the neutral point on the equipment and/or the earth bus, as the case may be.

9.3.3 Loop Earthing/ Earth Continuity Conductor:

a) Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/ terminal of the upstream switch board by protective conductors.
b) Two protective conductors shall be provided for a switchboard carrying a 3-phase switchgear thereon.
c) Loop earthing of individual units will not be however necessary in the case of cubicle type switchboards.
d) The earth connector in every distribution board (DB) shall be securely connected to the earth stud/earth bar of the corresponding switch board by a protective conductor.
e) The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protected conductor. Where the switch boxes by protective conductor. Where the switch boxes are of non-metallic type, these shall be looped at the socket earth terminals or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.

9.3.4 Prohibited Connection:

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a earthing conductor.

9.4 Earth Resistance:

a) 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 approve earth testing apparatus. In rocky soil the resistance may be up to 8 ohms.
b) Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode (s), different type of electrode or artificial chemical treatment of soil etc. as may be directed by the Engineer-in-Charge.

9.5 Marking:

a) Earth bars/ Terminals at all switch boards shall be marked permanently, either as "E" or as specified in Drawing/ SLD/ BOQ.
b) Main Earthing terminal shall be marked "Safety Earth- Do not Disconnect".

10 HIGH VOLTAGE PANEL

These specifications cover the detailed requirements for supply, installation, testing and commissioning of 11kV THREE HT PANEL BOARD (OUTDOOR TYPE) SF6 VCB Panel.

10.1 Reference Codes and Standard:

The design of the switchgear shall be exclusive and specific responsibility of supplier and shall comply with current good engineering practice, the relevant codes and recommendation, the project specific requirement. The electrical switchgear and the relevant equipment shall be designed, manufactured and tested according to the latest version of standards as listed below:

IEC 62271-1	Common Specifications for Switchgear & Control gear
IS 13118:1991 / IEC 62271-100	Vacuum Circuit Breakers
IS 3427 / IEC 62271-200	A.C. metal-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 72kV and the IEC Code herein referred
IEC 60129	Alternating current Disconnector (isolators)
IS 2705	Current transformers
IS 3156	Voltage transformers
IEC 60255	Electrical relays
IEC 60529	Classification of degrees of protection provided by enclosures

10.2 Rating:

All panels assembled to form a board shall be suitable for the nominal operation voltage and rupturing capacity as specified and suitable for operation on 11kV 3Phase 50Hz system.

10.3 Material:

a) The HV Panel Board shall be made of CRCA sheet steel.
b) The HV panel shall be floor mounting and free standing type.
c) The sheet thickness shall be of 2mm and gland plate shall be 3mm thick or as mentioned BOQ.

10.4 General Construction Features:

a) Separately door earthed compartments shall be provided for circuit breakers, bus bars, relay & instruments, CT&PT and cable boxes, fully and effectively segregating these from one another so that fault in any one compartment do not cause damage to equipment(s) in other compartment(s).
b) The observation window on the Circuit Breaker compartment door shall be made of special toughened/ laminated glass of at least 6mm thick.
c) The switch board shall have passed internal arc faulted containment testing for each compartment for 1 second at the rated fault current of 21 kA for 11kV.
d) Each HV compartment should have individual exhaust channel/ pressure relief flaps to let out over-pressurized hot gases at the top of the switch board in case of an internal fault.
e) Suitable factory fitted arc duct arrangement shall be provided for vending out the arc out of the switchgear room.
f) Front access doors with single action operator will be provided to the HV circuit breaker compartment.
g) The housing shall be of bolted construction to ensure compact and rigid structure, presenting a neat and pleasing appearance.

h) The Degree of enclosure protection shall be IP-4X for Indoor and IP-5X for outdoor.
i) The panels shall be bolted together to form a continuous flush front switch gear suitable for front operation of board and for extension at both ends.

10.5 General Design Aspects:

The HV panel board shall be designed such that the switchgear, instruments, relays, bus bars, small wiring etc. are arranged and mounted with due consideration for the following:

a) Facility for inspection, maintenance and repairs of testing terminals and terminal boards for ease of external connection.
b) Minimum noise and vibrations.
c) Risk of accidental short circuits and open circuits.
d) Secured and vibration proof connections for power and control circuits.
e) Risk of accidental contact and danger to personnel due to live connections.
f) Mountings at approachable height min. 300mm max. 1800mm from finish floor level.

10.6 Circuit Breaker:

10.6.1 General Arrangement:

The circuit breaker panels shall be complete with the following:

a) Racking in/ racking out mechanism.
b) Isolating plugs and sockets.
c) Mechanical On/Off indicator.
d) Minimum of 4NO and 4NC auxiliary contacts directly operated by the circuit breaker. Additional NO & NC contacts can be provided with auxiliary contractors.
e) Anti- condensation space heaters suitable for operation on 240V 1Phase 50Hz AC for each panel wherever specified.
f) Suitable tripping arrangement.
g) Mechanical counter to assess the total number of operations of the breaker (If asked for specifically).

10.6.2 Type:

The circuit breaker shall be of horizontal/ vertical isolation, horizontal draw out pattern.

10.6.2.1 Breaker Truck:

a) The breaker carriage shall be fabricated from steel, providing a sturdy vehicle for the circuit breaker and its operating and tripping mechanism.
b) The carriage shall be mounted on wheels, moving on guides, designed to align correctly and allow easy movement of the circuit breaker and for removing the carriage for inspection and maintenance purpose.
c) Vacuum interrupters shall be hermetically sealed and shall be designed for minimum contact erosion, fast recoveries of dielectric strength, maintenance free vacuum interrupter, suitable for auto-reclosing.
d) The drive mechanism shall preferably be provided with facility for pad locking at any position namely, “Service”, “Test” and “Fully Isolated”.
e) It should be possible for testing the circuit breaker for its operation without energizing the power circuit in the “Testing” position.
f) The contacts shall be made only after the breaker is inserted into service position.
g) Interlocking should prevent contacts from being disconnected if circuit breaker is tried to be moved from service position.

10.6.2.2 General Features:

Single break contacts are provided in sealed vacuum interrupter.

10.6.2.3 Rating:

The circuit breakers shall be continuously rated as specified with a minimum rated current as specified in BOQ with voltage rating and breaking capacity as specified.

10.6.2.4 Operating Mechanism:

The operating mechanism shall be one of the following as specified:

a) Manually operated spring charged
b) Motor wound spring charged with both mechanical and electrical release for closing.

The operating mechanism shall be trip free.

10.6.2.5 Auxiliary Supply:

External Auxiliary supply shall be made available for charging motors and heaters operation.

10.6.3 Bus bar Section:

10.6.3.1 General Requirement:

The switch board shall be single bus bar pattern with air insulated encapsulated bus bars housed in a separate compartment, segregated from other compartments.

10.6.3.2 Material:

The bus bars shall be of high conductivity electrolytic copper rated as specified in SLD and BOQ whichever higher.

The bus bars shall be sized for carrying the rated and short circuit current without over- heating.

Maximum bus bar temperature shall not exceed 95 degree C.

The switchgear and control gear shall be suitable for continuous operation under the basic service conditions indicated below or as per site conditions whichever high:

S.No.	Conditions	Specification
1.	Ambient Temperature	(-5) to (50) Deg C
2.	Relative Humidity	Up to 95%
3.	Altitude of Installation	Up to 1000m above MSL

10.6.4 Circuit Breaker Compartment:

Comprising the with-drawable Vacuum Circuit breaker for 12kV voltage level and all accessories required for its operation. To ensure the integrity of the arc fault containment requirement, the operations must be carried out with the switchgear doors closed i.e. circuit breaker for opening and closing, racking of circuit breaker (or withdraw-able voltage transformer) between service and test position.

Circuit breaker compartment door must be pad lockable.

Access between the circuit breaker (or withdraw-able voltage transformer) and bus bar/ cable compartments shall be made through epoxy encapsulated spout bushings of uniform shape and dimension. Spouts are covered by automatic metal shutters, covering all three phases unless the circuit breaker is in service position.

10.6.4.1 Circuit Breakers:

a) Circuit breaker shall be withdraw-able Vacuum type of floor rolling design. The complete assembly of interrupters, contact pressure springs and HV terminals (top and bottom) shall be type tested for compatibility of design.
b) Vacuum interrupters sourced from China shall not be acceptable even if it is from manufacturer of the CB.
c) The circuit breaker shall be suitable for E2, M2 & C2 (Single Capacitor Bank) class duty. The offered circuit breaker should have valid type tests to support the afore- mentioned duty cycle.
d) The circuit breaker shall be isolated by horizontal racking and positively fixing the unit into any one of the following positions:
e) Service Position: Main & Auxiliary circuit connected.
f) Test Position: Main circuits disconnected auxiliary circuits connected. Circuit breaker in its isolated position shall be completely contained in the apparatus compartment with shutters on main circuit closed and compartment front door closed.

g) Withdrawn Position: Main circuits and auxiliary circuits disconnected. Circuit breaker is removed out of the cubicle.
h) Locking of circuit breaker compartment door shall be possible by means of padlocking.
i) A position indicator switch or viewing window must be provided for visual indication of the circuit breaker position.
j) The circuit breaker control auxiliaries shall be of the plug and socket type.
k) The circuit breaker truck shall ensure earthing in both connected and disconnected positions.
l) An electro mechanical device shall be provided to ensure the auxiliary circuit have been securely connected between the fixed and moving portions of the switchgear, before allowing closing operation of the circuit breaker. The voltage rating of the device shall be same as the voltage used for the closing circuit.
m) Tripping and/ or release coils shall be continuous rated to ensure longer life.
n) The switchgear shall be provided with facilities for full operation from a remote point.
o) Circuit breakers shall be equipped with a motor wound spring stored energy operating mechanism with opening and closing operations independent of the operator, electric close and trip releases, manual on/ off buttons and manual spring charging facilities.
p) It shall be possible to manually charge the circuit breaker operating spring in case of auxiliary supply failure.
q) Mechanical indication of the spring charged condition shall be provided.
r) Circuit breakers shall be provided with a mechanically operated visual indicating device to display the circuit breaker switching state and a mechanical operation counter.
s) The circuit breaker operations of closing and opening shall be possible with the circuit breaker compartment door closed.
t) It shall be possible to trip the circuit breaker locally by mechanical means.
u) Circuit breakers will be provided with at least one spare normally open and one spare normally closed contact, even wired out to terminals for the connection of external wiring.
v) Circuit breakers shall be mechanical latching and electrical and mechanical tripping. The operating mechanism shall be trip-free and shall include an anti-pumping device.

10.6.5 Shutters:

a) Circuit breaker compartment should have automatic shutters, which shall be opened and closed by the mechanical drive of the circuit breaker.
b) The bus bar and circuit spout covers shall be operated independently of each other.
c) Padlock facilities can be provided on the metal shutters.

10.6.6 Current Transformer:

10.6.6.1 General Requirement:

Accommodation shall be provide in the circuit breaker panel to mount one set of three numbers dual core ratio CTs for metering and protection purposes. Access to the CTs for cleaning, testing or charging shall be from the front, back or top of the panel. All current transformers shall comply with IS 2705.

10.6.6.2 Rating:

a) Dual core & dual ratio CTs of suitable burden (but not less than 15 VA) shall be preferred with 1 Amps secondary. CT ratio shall be compatible with the loading pattern on HV side.
b) The CTs shall confirm to relevant Indian Standards. The design and construction shall be robust to withstand thermal and dynamic stresses during short circuit. Secondary terminals of CTs shall be brought out suitably to a terminal block which will be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 of IS 2705- Part III 1992.
c) The metering CTs shall conform to the metering ratio and accuracy class 0.5 for 11kV panel and class 0.2 for 33kV panel of IS 2705-1992.

10.6.7 Voltage Transformer:

10.6.7.1 General Requirement:

A voltage transformer of burden should not be less than 100VA and of proper ratio as per total system requirement. All voltage transformers shall comply with IS 3156.

The accuracy class for the VT shall be class 0.5 for 11kV and 0.2 for 33kV as per IS 3156 Parts I to III.

The transformer shall be of cast epoxy resin construction. It shall be fixed/ withdraw-able type. Control SP HRC fuses/ MCBs shall be provided on both HV and LV sides.

10.6.7.2 Protection and Tripping Arrangement:

Protection:

a) The relays shall be microprocessor based numerical relays with O/L, E/F and S/C protection. Tripping relay shall be used for tripping signal to the shunt trip coil of circuit breaker operating on 24V/ 30V DC supply/ Power Pack/ 110 Volt VT supply.

b) Alternatively, Power Pack converters fed could be provided. In cases where tripping is fed through PT, VA burden of PT shall be suitably increased depending upon the number of panels and connected controls/ Load etc.

c) 12V/ 24V/ 48V DC output shall be provided through power pack capacity as per system requirement for both protection as well as indications.

Input	:	90-130V
Battery	:	7 AH/ 18 AH/ 22 AH SMF type
Indicator	:	Mains on charger ON fails & DC ON

Relays:

a) The offered relay should be numerical and communicable design and should be of flush mounting design. The relay should be designed for selective protection of feeders in utility and industrial power systems in primary as well as secondary distribution network.

b) The offered relay shall have minimum 5 fault records and 100 event records with date and time stamp. It should have a universal auxiliary supply.

c) The relay shall be communicable on standard Modbus open protocol with at least one communication port. The relay shall offer multi-level password protection to guard against unauthorized access.

d) The relay should have a 2 x 16 character LCD display and support on-line current measurement and display in primary values. The relay should have 3 dedicated LEDs for ready, start & trip and 3 separate LEDs for fault indications.

e) Inrush protection should be a built in feature for stability during transformer energizing. Offered relay should also have built in trip circuit supervision feature.

f) Relay should have minimum of 4 nos of galvanically isolated and freely configurable binary inputs. It should also have 6 nos of binary outputs, out of which a minimum of 2 nos should be of sufficient rating to trip the circuit breaker.

g) Relay should offer 51, 51N, 50-1, 50-2 & 50N.

Control Wiring:

Control wiring shall be carried out with 1100V grade FRLS PVC insulated copper flexible wire and following colour standard.

S.No.	Control Circuits	Size and Colour
1.	AC Voltage Circuit	2.5Sqmm Red, Yellow, Blue and Black
2.	Current Circuit	2.5Sqmm Red, Yellow, Blue and Black
3.	AC Current Circuit	
i.	Phase	2.5Sqmm Red
ii.	Neutral	2.5Sqmm Black
4.	DC Voltage Circuit	
i.	(+)	2.5Sqmm Red
ii.	(-)	2.5Sqmm Black
5.	Grounding	2.5Sqmm Green

Note: The wiring shall be securely fixed and neatly arranged to enable easy tracing of wires. Identification tags shall be fitted at both ends to all power and control wire terminals to render identification easy and to facilitate checking in accordance with IS 375. Necessary terminal blocks and cable entries shall be provided for RTD relay wiring, power supply etc.

10.6.8 Metering Instrument, Panel Accessories (Digital):

10.6.8.1 Metering with RS485 Port:

The digital meters shall conform in all respects to international standards –IEC 62305-21-22 or the relevant Indian Standards, RoHS compliance with latest amendments thereof. MFM shall be provided in all incomers and outgoings as shown in SLD/ BOQ, having following characteristics:

a) Bright LED display with more than 25 Parameters: VLL, VLN, A, Hz, W, PF, VA, Wh.
b) Load hours, run hours, old Wh, Old load hour.
c) Auto scaling capability in variance of kilo, Mega, Giga.
d) High accuracy with class 0.5 for 11kV/ Class 0.2 for 33kV.
e) Positive energy accumulation even with CT polarity reversal with reversal with reverse lock programmable.
f) Password protection for tamer proofing.
g) Site selectable CT/ PT ration.
h) Site selectable CT secondary 1A/ 5A.
i) Input Voltage- 80-300V AC/ DC, 40-70Hz.
j) Seamless integration into any Modbus compatible SCADA Energy Management System (EMS).

10.6.9 Voltage Selection Scheme:

Where a bus coupler is incorporated and only one incomer feeder (out of two available) is intended to be operated at a time, a VT Transfer Relay shall be incorporated to provide necessary potential for metering. This will be necessary when energy metering is done on individual feeders or where VT supply is used for trip circuits. Alternatively PTs shall be provided on both the bus sections (incomers) with individual metering on each incomer.

10.6.10 Instrument Panels:

The instrument panel shall form part of the housing. They shall be preferably of flush mounting type at a maximum height of 1800mm.

Instrumentation:
The panel assembly shall also take care of the following requirements:

a) Lamp indication shall be provided to indicate ON/ OFF (by red green respectively) of switch gear.
b) Panel illumination lamp.
c) Mechanical indicating lamp for spring charged status.
d) Lamp indicating tripping at fault status.
e) Healthy trip supply shall be indicated by clear lamp.
f) Separate fuses/ MCBs shall be provided for lamps, heaters, voltmeters and other instrumentation etc. on each panel.
g) Anti-condensation space heater shall be provided and shall be suitable for operation on 240V, 1Phase, 50Hz AC for each panel.
h) Where there is more than one incomer and bus sections, these shall be castle key interlocked as per interlocking scheme as specified.

10.6.11 Cable Boxes:
Cable boxes shall be situated in a compartment at the rear/ side of the housing as specified.

10.6.12 Cable Entry:
Provision for top (bus ducts preferred for top entry only)/ bottom or such other side entry shall be made as per requirement with sufficient head room for cable termination.

10.6.13 Earthing:
The earthing of the breaker body and moving portion shall be so arranged that the earthing of the non-current carrying structure to the frame earth bar is completed well before the main circuit breaker plugs enter the fixed house sockets.
The entire panel board shall have a common tinned copper earth bar of suitable section with 2 earth terminals for effectively earthing metallic portion of the panels. The frame earthing of panel shall be provided 50x6mm hot dipped GI strip.

10.6.14 Installation:
The installation work shall cover assembly of panels lining up, grouting the units etc. In the case of multi panels switch boards after connecting up the bus bar all joint shall be insulated with HV insulation tape or with approved insulation compound.
Where trip supply battery is installed the unit shall be commissioned, completing initial charging of batteries. All relay instruments and meters shall be mounted and connected with appropriate wiring. Calibration checks of units as necessary and required by the licensee like CTs, VTs Energy Meters etc. shall be completed before pre-commission checks are undertaken.

10.6.15 Testing and Commissioning:
Procedure for testing and commissioning of relay shall be in general accordance with good practice.
Commissioning checks and tests shall include in addition to checking of all small wiring connections, relays calibration and setting tests by secondary injection method and primary injection method. Primary injection test will be preferred for operation of relay through CTs.
Before panel board is commissioned, provision for the safety namely fire extinguishers, rubber mats and danger board shall be ensured. In addition all routine megger tests shall be performed. Checks and test shall include following:

a) Operation checks and lubrication of all moving parts.

b) Interlock function checks.
c) Continuity checks of wiring, fuses etc.as required.
d) Verification of wiring
e) Trip test and protection gear tests.
f) The complete panel shall be tested with 5000V megger for insulation between poles and poles to earth. Insulation test of secondary of CTs and VT to earth shall be conducted using 500V megger.
g) Any other tests as may be required by the Licensee/ Inspector shall be conducted.
h) Where specified, the entire switch board shall withstand high voltage test after installation.
i) Any other test required by the consignee/ inspecting officer.
j) Withstand voltage at power frequency and on auxiliary circuits.
k) Visual inspection, operation of functional locks, interlocks, signaling devices and auxiliary devices.
l) Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism.
m) Measurement of the resistance of the main circuit.

10.6.16 Quality Control:

The bidder shall submit with the offer, assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and after finishing, bought out items and fully assembled component and equipment including drives. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's or its nominated representative engineer shall have free access to the manufacturer/sub-supplier's works to carry out inspections.

10.6.17 Testing Facilities:

Bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

10.6.17.1 Manufacturing Activities:

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage with quantity. This bar chart shall be in line with the Quality Assurance Plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.

10.6.17.2 Drawings & Documents:

Following drawings and documents shall be prepared based on PURCHASER specifications and statutory requirements and shall be submitted with the bid:

a) Completely filled in Technical Particulars
b) General description of the equipment and all components including brochures.
c) Power flow diagram
d) Foundation plan
e) Bill of material
f) Experience List
g) Type test certificates

STANDARD SPECIFICATION OF PIPE WORK AND VALVES

1.0 GENERAL

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder:

2.0 PIPES

The pipes and valves shall be of approved make given in the NIT.

Water pipes shall be "C" Class M.S. E.R.W. Black pipes and shall conform to IS: 1239 (Part-I) – 1991 & IS: 3589 – 1991 with latest amendments.The wall thickness of "C" Class M.S. E.R.W.Black pipes as per IS: 1239 (Part-I) and flanges thickness as per IS: 6392 (Table-17) shall be as follows:

Sl. No.	Nominal Pipe Dia in mm	Wall Thickness of Pipe in mm	Thickness of Flanges in mm
1.	25	4.00	16
2.	32	4.00	16
3.	40	4.00	16
4.	50	4.50	18
5.	65	4.50	18
6.	80	4.80	20
7.	100	5.40	20
8.	125	5.40	22
9.	150	5.40	22
10.	200	6.00	24
11.	250	6.00	26
12.	300	6.00	28

3. Fittings

3.1 The dimensions of the fittings shall conform to I.S. 1239-69 Part-II unless specified otherwise in specifications.

3.2 All bends in sizes up to and including 150 mm dia shall be ready made of heavy duty, mild steel of same class as specified for pipes.

3.3 All bends in sizes 200 mm and larger dia shall be fabricated from pipes of the same dia and thickness, with a minimum of five sections, each segment making a 17deg bend and having a minimum centre line radius of 1.5 times diameter pipe diameter.

3.4 All fittings such as branches, reducers etc. in all sizes shall be fabricated from pipes of the same dia and thickness, and its length should be at least twice the dia of the pipe.

Blank ends are to be formed with flanged joints and 6 mm thick blank between flange pair for 150 mm and over in case where, a future extension is to be made, blank end discs of 6
thickness are to be welded on, with additional cross stiffeners from 50 mm x 50 mm x 5 mm MS heavy angles, for sizes up to 350 mm, all ends larger than 400 mm Dia shall have dished ends.

4.0 FLANGES

4.1 All flanges shall be of mild steel as per I.S. 6392/71 and shall be steel slip-on-type, welded to the pipes, flanges thickness shall be to suit class-II pressures.

4.2 Flanges may be tack welded into position, but all final welding shall be done with joints dismounted. 5mm thick Neoprene gaskets shall be used with all flanged joints. The gaskets shall be fiber-reinforced rubber as approved by the Engineer-in-Charge. Special adhesive compound shall be used between flanges of steam, air and gas lines.

4.3 Flanges shall be used as follows:

4.3.1 Counter flanges for equipment having flanged connections.

4.3.2 Flanged pairs shall be used on all such equipment, which may require to be isolated or removed for service e.g. pumps, Air washer units etc.

4.3.3 All threaded valves shall be provided with nipples and flanged pairs on both sides to permit flange connections, for removal of valves from main lines for repair/replacement.

5.0 <u>VALVES</u>

5.1 BUTTERFLY VALVES

5.1.1 The butterfly valve shall consist of cast iron body of IS 210FG220 preferably in two piece construction.

5.1.2 The disc shall consist of disc pivot OF SG iron IS 1865 Gr. 400/12 and driving stem shall be made of SS AISI 410 and in one piece centrally located conforming to IS 13095.

5.1.3 The valve seat shall be synthetic material nitrile suitable for water duty. It shall line the whole body and should be field replaceable/integrally moulded.

5.1.4 The disc should move in slide bearings on both ends with 'O' ring to prevent leakage.

5.1.5 The handle should have arrangement for locking in any set position.

5.1.6 The valve should be suitable for 16 Kg/Sq.M working pressure.

5.1.7 All the valves above 32 mm Dia shall be butterfly type.

5.2 GATE/GLOBE VALVE

5.2.1 All gate valves and Globe valves shall be of gun metal screwed type, and shall have non rising type spindle, conforming to class 2 of I.S. 778 and shall be with I.S.I. marking and certification and tested upto a pressure of 21 kg/sq.cm.

5.3 CHECK VALVE

5.3.1 All Check valves upto 50 mm dia shall be of GM screw type and shall be conforming to I.S. 778 and of I.S.I marked and certification

5.3.2 All check valves above 50 mm shall be wafer type dual plate.

5.3.3 The body of check valve shall be of cast iron of grade IS 210 FG 220.

5.3.4 The flap shall be made of SS AIASI 304 or SG iron IS 1865GR 400/12.

5.3.5 The hinge and stop pin shall be of SS AISI 304/410 and spring shall be SS AISI 304/316

5.3.6 The valve shall be suitable for 16-kg/sq.-cm. Working pressure and shall be factory tested at 21-kg/sq. cm.

6.0 BALANCING VALVES

6.1 The balancing valves shall be capable of measuring, regulating and isolating the flow.

6.2 The balancing valves up to 40 mm dia shall be of gunmetal screwed type and 50 mm dia. And above shall be C.I double-flanged type confirming to B.S. 1452 or equivalent specifications.

6.3 The balancing valves shall be made of stainless steel AISI 410. All other internals shall be non-corrosive material preferably of forged brass.

6.4 The port opening shall permit precise regulation of flow rate, by accurately measuring the pressure drop across the port.

6.5 The valve shall be complete with two ports for connections to a mercury manometer, to measure the pressure drop, as well as drain port.

6.6 The spindle shall have a shielded/concealed locking screw to avoid the tempering of the setting after balancing.

6.7 The valves must have easily accessible pressure drop measuring facility.

6.8 The balancing valve shall have indication of number of turns on hand wheel preferably digital type.

6.9 The balancing valve shall be used in lieu of butterfly/gate/globe valves and shall be suitable for working at 16 kg/sq.cm working pressure.

7.0 PID/2 Way Modulating/Flow Control Valve

7.1 The Self balancing flow control valves shall be pressure independent, 2-way, modulating type to accept input signals from the control system.

7.2 Each Air Handling Unit shall be provided with a 2 Way Pressure Independent cum Balancing cum Control Valve integrated in a single Body.

7.3 Diaphragm based delta p controller shall ensure 100% valve authority & linear characteristics at all loads and setting. The cartridge is not acceptable.

7.4 Control - Valve shall be equipped with electronic modulating gear type actuator which can accept either 4(0)-20mA / 2(0)- 10V DC signals. Operating voltage for actuator shall be 24V AC (thermal/wax not acceptable).

7.5 All Valve actuators shall be microprocessor based with self-calibrating feature.

7.6 Valve Actuator combination shall be able to give logarithmic control characteristic to achieve linear control.

7.7 Actuator shall be able to work against pump head or maximum closing pressure.

7.8 For Manual override, it shall not involve opening of actuator body.

7.9 Each Valve shall have a stepless adjustable maximum flow limitation as per the designed flow rate of coils.

7.10 The balancing shall be done only in the valve not in the actuator so that in case of actuator failure the balancing is not lost and easily accessible.

8.0 STRAINERS

8.1 The strainers shall either be pot type or 'Y' type with cast iron or fabricated steel body, tested upto pressure applicable for the gate valves as shown on the drawings.

8.2 The strainer's screen shall have a perforated bronze sheet of 22-gauge thickness with 3 dia having an area of 60% perforation and with a permanent magnet, to catch iron fillings.

8.3 All pumps shall have suction guide with strainer in pump suction.

9.0 JOINTING

9.1 All pipelines shall be welded type.
9.2 Square cut plain ends will be welded for pipe up to and including 100 mm dia.
9.3 All pipes 125mm dia. or larger will be bevelled by 35 Deg. for welding.

10.0 MISCELLANEOUS

10.1 Proving all piping, required to make the apparatus connected, complete and ready for regular and safe operation, unless otherwise noted, connect all apparatus and equipment in accordance with manufacturer's standard details, as approved by the Engineer-in-Charge.
Consult drawings and specifications to determine number and requirements of all items of equipment, requiring piping, such as bend, drain, relief etc., wherever equipment is provided with connections for such piping.

10.2 Providing valves and capped connections for all low points in piping system, necessary or required for draining systems. Provide for all risers isolating valves and drain valves to permit repairs without interfering with the rest of the system.

10.3 During construction, temporarily close, open ends of pipes with sheet metal caps, where necessary, or required to prevent debris from entering piping system.

10.4 Support piping independently of all equipment so that the equipment is not stressed by the piping weight or expansion.

10.5 To facilitate the maintenance, repair and replacement.

10.6 Unions, if used, shall be flanged, as required, where indicated and in connections to all equipment, apparatus, and specialties requiring disconnection for repairs or replacement, locate unions between shut-off valves and equipment as directed by Engineer-in-Charge.

10.6.1 Provide shut-off valves where indicated and for individual equipment, units at inlet and outlet, to permit unit removal for repairs, without interfering with the remainder of the system Additional shut-off valves shall be provided as required to enable all systems to be fully sectionalized. By-pass and stop valves shall be provided for all automatic control valves as specified.

10.6.2Arrange piping for maximum accessibility for maintenance and repair, locate valves for easy access and operation. No valves shall be installed with handles pointing down, unless unavoidable.

10.6.3 Cut the pipes accurately according to measurements, established at building and work into place without springing or forging.

10.6.4 Pipe supports shall be adjustable for height and primer coated with rust preventive paint and finish coated with gray paint, both as approved by Engineer-in-Charge. Spacing of pipe supports shall not be more than that of specified below:-

10.6.5

	Nominal Pipe Size mm	Spacing (Meters)
	15	1.25
	20&25	2.00
	32,30,50 & 65	2.50
	80,100 & 125	2.50
	150 & ABOVE	3.00

10.6.6 Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stresses on the pipes. Pipe hangers shall be fixed on walls and ceiling by means of metallic approved dash fasteners.

10.6.7 Insulated pipe shall be supported in such a manner as to not to put undue pressure on the insulation.

10.6.8 Where pipes are to be buried under ground following procedure and specifications to be adhered. The top of the pipes shall not be less than 75 Cms. from the ground level. Where this is not practical permission of Engineer-in-Charge shall be obtained from burying the pipes at lesser depth.
The pipes shall be surrounded on all sides by sand cushions of not less than 15 cms. After the pipes have been laid and top sand cushions provided, the trench shall be refilled with the excavated soil, excess soil shall be removed from the site of work by the Contractor.
Apply a coat of bitumen.
Fix the tarfelt sheet with the help of bitumen, followed by another thick coat of bitumen.

11.0 HANGERS & SUPPORTS

11.1 Hangers and supports shall be provided and installed for all piping and tubing wherever indicated, required or otherwise specified. Wherever necessary, additional hangers and supports shall be provided to prevent vibration or excessive deflection of piping and tubing.

11.2 All Hangers and supports shall be made of steel or other durable and non- combustible materials, galvanized or plated. Wood wire or perforated strap iron shall not be used as permanent hangers or supports.

11.3 Hangers shall be supported from fabricated structural steel secured with expansion bolt in reinforced concrete slab/beams. Similarly, pipe racks shall be fabricated with structural steel and secured with expansion bolts in RCC slab/beams.

11.4 No hangers shall be secured to underside of lightweight roof decking and lightweight floor glass.

11.5 Mechanical equipment shall be suspended midway between steel joints and panel points.

11.6 Drilling or punching of holes in steel joist members will not be permitted.

11.7 All nuts, bolts and washers shall be of G.I only.

11.8 all Hot water piping in A.C. plant room and other areas shall be duly supported with high density polyurethane foam (P.U.F.) supports of block type so as to provide insulation as well as take load of piping. These supports would be fixed with rubber sheet and clamps. Placing of these supports are as per design parameters keeping in mind the load factor of bare pipe plus fluid weight and vibratory movement of the pipes. Suggested distance for placing these supports as mentioned in 9.6.4.

12.0 SLEEVES

12.1 Where pipes pass through floors, provide galvanised steel pipe sleeves 50 mm larger than outside diameter of pipe. Where pipes are insulated, sleeves shall be large enough to ample clearance for insulation.

12.2 Where pipes pass through outside walls or foundations, the space between pipe and sleeve shall be caulked with lead wood and oakum.

12.3 The center of pipes shall be in the center of sleeves and sleeves shall be flush with the finished surface.

13.0 ARRANGEMENT AND ALIGNMENT OF PIPING

13.1 All piping shall be arranged and aligned in accordance with the drawings as specified. Where special conditions are encountered in the field, the arrangement and alignment of piping shall be as directed by the Engineer-in-Charge.

13.2 The piping shall be installed in a uniform manner, parallel to or perpendicular to walls or ceilings, and all changes in directions shall be made with fittings. The horizontal piping shall be run at right angles and shall not run diagonally across rooms or other piping. Wherever possible all piping shall be arranged to provide maximum headroom.

13.3 All piping shall be installed as directly as possible between connecting points in so far as the work of other trades permits. Where interference occurs with another trade whose work is more difficult to

route, this Contractor shall re route his pipes as required to avoid interference, at the discretion of the Engineer-in-Charge.

13.4 All piping shall be carefully installed to provide for proper alignment, slope and expansion.

13.5 The stresses in pipe lines shall be guided and pipes shall be supported in such a manner that pipe lines shall not creep, sag or buckle.

13.6 Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping.

13.7 Small tubing for gauges, controls or other equipment installed on any apparatus shall not be coiled nor excessive in length, but shall be installed neatly, carefully bend at all changes in direction, secured in place and properly fastened to equipment at intervals to prevent sagging.

13.8 The piping shall be grouped wherever practical and shall be installed uniformly in straight parallel lines in either vertical or horizontal positions.

15.0 TESTING

15.1 In general, tests shall be applied to piping before connection of equipment and appliances. In no case shall piping equipment or appliances be subjected to pressures exceeding their test ratings.

15.2 The tests shall be completed and approved before any insulation is applied. Testing of segments of pipe work will be permitted, provided all open ends are closed, with blank-offs or flanges.

15.3 After tests have been completed the system shall be drained and flushed 3 to 4 times and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fillings and debris.

15.4 All piping shall be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 Kg/Sq. cm for a period of not less than 24 hours. All leaks and defects in the joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge, without any extra cost.

15.5 All the piping systems shall be tested in the presence of the Architect or Engineer-in-Charge or their authorized representative. Advance notice of test dates shall be given and all equipments, labour, materials required for inspection and repairs during the test shall be provided by the Contractor. A test shall be repeated till the entire systems are found satisfactory to the above authority. The tests shall be carried out for a part of work if required by Engineer-in-Charge in order to avoid hindrance in the work of the insulation Contractor.

15.6 The Contractor shall make sure that proper noiseless circulation is achieved through all piping systems. If due to poor air bond, proper circulation is not achieved, the Contractor shall bear all expenses for carrying out the rectification work including finishing of floors, walls and ceiling damaged in the process of rectifications.

15.7 The Contractor shall provide all labour and materials to make provision for removing water and throwing it at the proper place during the testing or/and after the testing to avoid damages to employer or other Contractors properties. Any damages caused by the Contractor to the employer or other Contractors' properties, shall be borne by the Contractor.

16.0 AIR VENTS

16.1 Air vents for purging of air trapped in piping system shall be provided at the highest point. Globe valves of the size indicated below shall be provided

Pipe Size	Valve Size
Upto 100mm	25mm dia
Above 100mm	40mm dia

17.0 DRAIN PIPING

17.1 The drain piping shall be medium class galvanized steel as per IS 1239/1979.

17.2 The fittings shall be forged with screwed connections.

17.3 The gate valves shall be of gun metal as described earlier.

17.4 Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.

17.5 The drain line shall be provided up to the nearest drain trap and pitched towards the trap along with a P-Trap at the bottom of each vertical drainpipe.

17.6 Drain lines shall be provided at all the lowest points in the system, as well as at equipment's, where leakage of water is likely to occur, or to remove condensate and water from pump glands.

18.0 PAINTING

18.1 All pipes supports, hangers, etc. shall be given two coats of Zinc Chromate or Red Lead primer.

18.2 All pipes, which are not to be insulated, shall then be given one coat of finish paint, of a type and colour, as approved by the Engineer-in-Charge.

SECTION-XII

LIST OF APPROVED MAKES OF MATERIALS

List of Approved Makes/Brands of Materials/Equipment

(CIVIL, INTERIOR, PLUMBING, ELECTRICAL, FIRE FIGHTING)

"Construction of UG OR Living Bunkers (20 Nos.) and UG Tac HQ (4 Nos.) along three different axises from Durbuk in the UT of Ladakh"

Sl. No.	Material/Equipment	Makes/Brands
A.	**CIVIL WORK**	
1	Cement	ACC, Ultratech, Ambuja, Vikram, Birla cement, JK Cement, Shree cement & Jaypee Cement
2	Reinforcement Steel / Structural Steel	SAIL, Tata Steel, RINL, Jindal
3	ALUMINIUM Extrusion /SECTIONS	Jindal, Hindalco, Indalco
4	Aluminium Accessories and Hardware	Hardima, Everite, Sigma, Argent, Classic,Jyoti
5	Aluminium Composite Panels	Alucobond, Reybond
6	Anchor Fastner/Dash Fastner	Hilti, Fisher, Canon
7	Ready Mix Concrete (RMC)	Ultratech, ACC, RMC India
8	Concrete Additive	Pidilite / Fosroc / Fairmate / MC Bauchemie/ Sika/ Cico
9	Door closer / Floor spring	Dorma,Godrej, Geze,Yale, Ozone
10	Door Locks	Godrej/Ingerroll Rand, Dorma
11	Factory made Laminated Door Shutters	Greenply , Kitply
12	Doors & Windows Fixtures / Fitting.	Godrej/Everite / Classic/ Crown / Earl Bihari
13	uPVCwindows/ventilators	Fenesta,Wintech,Winplast,Rehau
14	Paints (Exterior Emulsion Paint)	Asian (Apex Ultima)/ Berger (Weathercoat all Guard)/ ICI (Dulux weathershield max)
15	Paints - Other Paints / Primer	ICI Dulux/ Asian/ Berger/ Nerolac
16	Paints - Texture paint	Berger / Spectrum / Unilite Heritage /Asian
17	CC Paver blocks / Tiles (All Types)	KK / Uni Stone Products (India) Pvt. Ltd/ Hindustan Tiles/ NITCO
18	Epoxy Flooring	Fosroc/ Dr. Beck/ Flamaflor
19	False Ceiling - Calcium Silicate Boards & Tiles	India Gypsum/ Armstrong / Hilux / Saint Gobain (Gyproc)/Aerolite
20	False Ceiling - Metal	Armstrong / Hunter-Douglas / USG-Boral/ Saint Gobain/ Unimet
21	False Ceiling - Mineral fibre	Armstrong / Decosonic / USG-Boral/ AMF/ Saint Gobain (Gyproc)
22	Fire Rated Doors & Frames	Navair / Shakti-Hormann / Pacific/Promat
23	Fire Rated Glass	Asahi India Safety Glass Ltd./ Saint Gobain/ Pilington, Schott, Pyroguard, Glaverbel
24	Fire Retardant Paint	Viper FRS 881/ Nullifire/ Berger
25	Fire Seal	Sealz, Alstroflam/ Abacus
26	Fire: Door Closures, Mortice Dead locks	Becker Fire Solution/ Inersoll Rand/ Dorma/Godrej/ Geze/ Hafele
27	Fire: Panic Exit Devices	Becker Fire Solution/ Inersoll Rand LCN Series/ Dorma PHA Series/ D-line/Godrej
28	Glass : Float & Mirror	Atul / Saint Gobain/ Asahi India Safety Glass Ltd

29	Glass for Aluminum Doors/ Windows/ Structural Glazing	Saint Gobain / Pilkington/ Asahi India Safety Glass Ltd.
30	GRC Jali	Unistone/ Kuber Fibrostone/Everest Composites/ Birla white
31	GRC wall cladding	Unistone/ Kuber Fibrostone/Everest Composites/ Birla white
32	Grout: Non-Shrink	Fosroc / Sikka/Pidilite or equivalant
33	Laminates/ Veneers	Century/Archidply/Greenlam/Formica/Sunmica/Merino
34	Night Latch	Godrej / Dorma/ Ozone/Harrison/Link
35	Paints - Cement Based	Snowcem Plus/, Berger (Durocem Extra)/ Nerolac (Super Acrylic)/ TATA Cem, Asian
36	Plywood/Block board/Ply board	Duroply / Greenply/ Archidply/ Century/ Kitply/ National / Anchor/ Merino
37	Silicon sealants /Weather Sealant/ Structural Glazing Sealant	GE- Silicon / Pidilite / Forsoc / Cico /Dow Corning / Sikka/ Wacker
38	Stainless Steel	Salem Steel/ Jindal or equivalent
39	Stainless Steel bolts, Screws, Nuts & Washers	Kundan / Puja / Atul
40	Stainless Steel Clamps	Hilti /Intellotech Koncept /Fisher
41	Stainless Steel Hinges	Hettich/ Godrej/ Dorma
42	Stone Adhesives	Fosroc / Sikka/Pidilite
43	Tiles: Ceramic Tiles	Kajaria / Somany/RAK/Nitco
44	Tiles: Glazed (Ceramic) tiles	Kajaria / Somany/RAK/Nitco
45	Tiles: Vitrified Tiles	Kajaria / Somany/RAK /Nitco
46	Vinyl Flooring	Wonder floor/Responsive
47	Water Proofing Materials	BASF/ Fosroc / Sikka / CICO / STP/ Pidilite/CHRYSO
48	Wooden Laminated Flooring	NITCO /Euro / Pergo /Armstrong
49	Expansion Joints	Sanfield (India) Ltd., MIGUA, TRISTAR
50	Automatic sliding door	Dorma or equivalent make
51	False flooring	Arena, unitile, or equivalent make
52	Roller blinds	Hunter dougles/ Phifer or equivalent make
53	M.D.F	Nuwood(Grade -I AND GRADE II), Durotuff
B	**PUBLIC HEALTH (PLUMBING)**	
1	Chinaware & CP Fittings	Hindware/Cera/Jaquar/Kohler
2	Butterfly Valve / Check Valve	Zoloto / Leader / Sant/ Audco/GPA
3	Ball Valves	Zoloto / Leader / Sant/ Audco/GPA
4	Cables	Skytone/Finolex/Polycab
5	PVC Copper Wire	Skytone/Finolex/Polycab
6	PP-R Pipes & Fittings	SFMC/Prince/Supreme
7	PP Pipe	Astral (Silencio) / Huliot(Ultra Silent), Poloplast
8	GI Pipes & Fittings	TATA/Jindal/Swastik
9	Rain Water Pipe (uPVC SWR Type-A)	Supreme/Prince/Astral
10	SS Sink	Hindware / Neelkanth / Nirali / Jayna /Neropure
11	Stainless Steel Grating	Camry / Chilly/Jayna
12	Air Release Valve	SANT/KARTAR/ZOLOTO

13	Gully Trap	Perfect / S.K.F/ R.K/ Hind / Anand
14	S.F.R.C. Manhole covers	K.K. Manhole and grating Co.
15	DWC Pipes	Astral / Supreme/ Prince
16	PVC encapsulated Foot rest	KK Manhole / KGM / Bentex
17	SUBMERSIBLE PUMP	GRUNDFOSS/ KSB / KIRLOSKAR/CROMPTON/MATHER & PLATT
18	HYDROPNEUMATIC SYSTEM	GRUNDFOSS/ KSB / ITT LOWARA/LUBI
19	HEATPUMP	AO SMITH/ SUNTEC/ JAQUAR
20	SOLAR PANEL	EMVEE/TATA/ELECTRA
21	BIO DIGESTER	DRDO APPROVED
22	Pressure relief Valve	Leader, Sant, TIMMIE, AIP
23	Thermostatic Valve	Oventrop, Scheneider, Schell
24	WC Pan Connector	MC Alpine, Viega, Supreme
25	Tube well Pumps	GRUNDFOSS/ KSB / ITT LOWARA/LUBI
26	Insulation	Armafex, Thermaflex, Armaflex, K-flex

C. ELECTRICAL WORK		
1	MV/LV/ELV Cable-XLPE Insulated As Per IS:7098	RR kable/Polycab/KEI/Havells
2	Copper Bus Bars	RR Copper/Banco
3	Aluminium Busbars	Hindalco/Banco
4	Change Over Switch (Manual)	ABB/C&S/HPL/Indoasian/Socomec
5	LED Light Fixtures and Lamps	Havells/Philips/Wipro/Polycab/Light Technology
6	Lighting for Facade	Havells/Philips/Wipro/Polycab/Light Technology
7	Ceiling/Wall Fans & Exhaust Fans	Bajaj/Usha/Polycab/Crompton/Almonard/Khaitan/Orient
8	Lightening Arrestors	JMV/Triprotect/Dehn/OBO Bettermann
9	Earthing	JMV/Triprotect/Kors(Esteem)/Dehn/OBO Bettermann
10	Surge Protections	Argos/Schneider/JMV/OBO Bettermann/ABB
11	SFU/SDF/HRC FUSE	ABB/C&S/HPL/Indoasian/Socomec
12	MCB/ELCB/DB/RCCB Industrial Sockets-Sheet Metal Clad	Schneider/Legrand/C&S/L & T /ABB
13	Moulded Case Circuit Breaker (MCCB) Barriers, Spreader Links & Extended Rotary Handle	Schneider/Legrand/C&S/L & T /ABB
14	Air Circuit Breakers	Schneider/Legrand/C&S/L & T /ABB
15	Switches & Socket, Boxes And Faceplate Modular Type	Schneider/Legrand/Polycab/Panasonic
16	M.S. Conduit & Accessories	AKG/RM CON/BEC/Steel Krafts/Fitwell
17	PVC Conduit & Accessories	AKG/BEC/Polycab
18	Cable Trays & Raceway	Legrand/OBO/MEM/Rmcom
19	Time Switches	L&T Electrical & Automation Ic/Schneider/ Finder/Legrand/Crompton Greaves Limited/ABB/C&S
20	Push Buttons	L&T Electrical & Automation Ic/Teknik/Schneider/Kaycee/C&S
21	LED Type Indicating Lamps	L&T Electrical & Automation IC/Schneider/Kaycee/Teknik/ABB/C&S

22	Push Buttons Actuatos	L&T Electrical & Automation IC/Schneider/Kaycee/Teknik/ABB/C&S/MDS
23	Selector Switches / Rotary Switches	Kaycee/Legrand/Salzer/L&T Electrical & Automation IC/Gepower/C&S/Teknict/Schneider/Rockwell
24	Crimping Type Lugs & Thimbles	Dowells/Comet/Jointwel/Action
25	Cable Glands	Dowells/Comet/HMI/MIC
26	Brass Cable Glands	Dowells/Comet/HMI/MIC/Polycab/Siemens/Braco
27	Pvc Cable Glands	Trinity/Lotus/Neptune/Havells
28	Panel Cooling Fans	Rexonard/Rittal/Finder/Philips
29	Relays	Minilec/Prok Devices/Procom/Finder/C&S
30	Multifunction MetersDoor Mounted Dual Source Energy Meters	Newtek Electricals/C&S/Legrand/Neptune/Trinity
31	PLC/ Load Manager/ Sync. Relay	ABB/Siemens/Schneider/Allen Bredly
32	Fabrication Sheet	TATA Sheet/Bhushan Steel/Jindal Iron & Sheet
33	Automatic Transfer Switch	Asco/Russelectric/Eaton/Socomec
34	T.V. CO-Axial Cable	Delton/Bonton/RR Kable/ESC Cable
35	Solar	ABB/Wave shapes India/Delta
36	Street Light Poles	Sumip/Hensal/Bajaj
37	UPS	Emerson (Vertiv)/ Schnieder (APC)/ Eaton/ Socomec
38	Data/Telephone/TV Outlets	Schneider/Legrand/Polycab/Panasonic
39	Fire Extinguisher	Ceasefire/ Exflame/ Minimax/ Life Guard/ Safex
40	Battery Charger	Amaraja/ Sabnife/ Statcon/ Voltstat/ HBL
41	AC	LG/ Samsung/ Dakin/ O General/ Bluestar

SECTION-XIII

INTEGRITY PACT

INTEGRITY PACT

This integrity Pact is made at National Highways Infrastructure Development Corporation Limited (NHIDCL), RO-Ladakh on this ____day of _____ 2023.

BETWEEN

NATIONAL HIGHWAYS &INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED(NHIDCL) hereinafter referred to as "The Principal" (which expression, unless repugnant to the context thereof, shall mean and include its legal representatives, heirs and assigns)

AND

_____herein after referred to as "The Bidder "(which expression, unless repugnant to the context there of, shall mean and include its legal representatives, heirs and assigns)

Preamble

Whereas, The Principal intends to award, under laid down organizational procedures, contract(s) for _____ _____(hereinafter referred to as the 'Project'). The Principal necessarily requires full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/ transparencyin its relations with its Bidder(s)and/or Consultant(s).

In order to achieve these goals, the Principal has appointed _____ who will monitor the tender process and the execution of the contract for compliance with the Integrity Pact by all parties concerned, for all works covered in the Project. The contact details of Shri _____ are asunder- _____

Section 1 - Commitments of the Principal

The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

No employee of the Principal, personally or through family members or through any other channel, will in connection with the tender for or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit, which the person is not legally entitled to.

The Principal will, during the tender process treat all Consultant(s)/Bidder(s)with equity and reason. The Principal will in particular, before and during the tender process, provideto all Consultant(s)/Bidder(s)the same information and will not provide to any Consultant(s)/Bidder(s),confidential/additional information through which the Consultant (s)/Bidder(s) could obtain an advantage in relation to thetender process or the contract execution.

The Principal will exclude from the process all known prejudiced persons. The Principal shall obtain bids from only those parties who have been short-listed or pre- qualified or through a process of open advertisement/web publishing or any combination thereof.

If the Principal obtains information on the conduct of any of its employees, Consultant (s) and/or Bidder(s), which is a criminal offence under the IPC/PC Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and subject to its discretion, can additionally initiate disciplinary actions.

The Principal will enter into agreements with identical conditions with all Consultant(s)/Bidder(s)for the different Work Packages in the aforesaid Project....

(4) The Principal will disqualify from the tender process all Consultant (s)/Bidder(s) in the range of Rs 50 Crore and above, who do not sign this Pact or violate its provisions.

Section 2 - Commitments of the Bidder(s) / Consultant(s)

The Bidder(s) / Consultant (s) commit(s) itself/themselves to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

The Bidder(s)/Consultant(s) will not, directly or through any other person or firm offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage, of any kind whatsoever, during the tender processor during the execution of the contract.

The Bidder(s)/ Consultant (s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

The Bidder(s)/Consultant(s) will not use improperly, for purpose of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

The Bidder(s)/ Consultant (s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)/Consultant (s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/ Consultant(s). Further, as mentioned in the Guideline all the payments made to the Indian agent/representative have to be in Indian Rupees only .Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is annexed and marked asAnnex-"A".

The Bidder(s)/ Consultant (s) will, when submitting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

The Bidder(s)/ Consultant (s) will not instigate third persons to commit offences outlined above or be an accessory to suchoffences.

Section 3: Disqualification from tender process and/ or exclusion from future contracts.

If the Bidder(s)/ Consultant(s), before awarding the Project or during execution has committed a transgression by violating Section 2 above or in any other form so as to put his reliability or credibility in question, the Principal, at its sole discretion, is entitled to disqualify the Bidder(s)/ Consultant (s) from the tender process or terminate the contract, if already awarded, for that reason, without prejudice to any other legal rights or remedies available to the Principal under the relevant clauses of GCC/SCC of the tender/contract.

If the Consultant (s)/Bidder(s) has committed a transgression through a violation of any of the terms under Section 2 above or in any other form such as to put his reliability or credibility into question, the Principal will also be entitled to exclude such Consultant (s)/Bidder(s) from future tenders/contract award processes. The imposition and duration of the exclusion will be determined by the Principal, keeping in view the severity of the transgression. The severity will be determined by the circumstances of the case, in particular, the number of transgressions and/or the amount of the damage.

If it is observed after payment of final bill but before the expiry of validity of Integrity Pact that the Consultant has committed a transgression, through a violation of any of the terms under Section 2 above or any other term(s) of this Pact, during the execution of contract, the Principal will be entitled to exclude the Consultant from further tender/contract award processes.
The exclusion will be imposed for a minimum period of six (6) months and a maximum period of three (3) years.

If the Consultant (s)/Bidder(s) can prove that he has restored/recouped the damage to the Principal caused by him and has installed a suitable corruption prevention system, the Principal may, at its sole discretion,revokeor reduce the exclusion period before the expiry of the period of suchexclusion.

Section 4: Compensation for Damages

(1) If the Principal has disqualified the Bidder(s)/ Consultant (s) from thetender process priortothe awarding of the Project according to Section 3, the Earnest Money Deposit (BID SECURITY)/Bid Security furnished, if any, along with the offer, as per terms of the Invitation of Tender, shall also be forfeited. The Bidder(s)/Consultant(s) understands and agrees that this will be in addition to the disqualification and exclusion of the Consultant (s)/Bidder(s) as may be imposedby the Principal, in terms of Section 3 above.

If, at any time after the awarding of the Project, the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Security Deposit/Performance Bank Guarantee furnished by the Consultant, if any, as per the termsof the NIT/Contract shall be forfeited without prejudice to any other legal rights and remedies available to thePrincipal under the relevant clauses of General/ Special Conditions of Contract.

The Consultant (s)/Bidder(s) be in addition to the Bidder(s)/ Consultant (s), as terms of Section 3 above. Understands and agrees that this will disqualification and exclusion of the may be imposed by the Principalin

Section5: Previous transgression

The Bidder(s)/ Consultant (s) herein declares that it has committed no transgressions in the last 3years with any other Company in any country conforming to the anti corruption approach as detailed herein or with government/ any other Public Sector Enterprise in India that could justify its exclusion from the tender process.

If at any point of time during the tender process or after the awarding of the Contract, it is found that the Bidder(s)/ Consultant (s) has made an incorrect statement on this subject, he can be disqualified from the tender process or if, as the case may be, that the Contract, is already awarded, it will be terminated for such reason and the Bidder(s)/ Consultant (s) can be black listed in terms of Section 3 above.

Section 6: Independent External Monitor / Monitors

The Principal shall, in case where the Project Value is in excess of Rs 50 Crore and above, appoint competent and credible Independent External Monitor(s) with clearance from Central VigilanceCommission. The Monitor shall review independently, the cases referred to it to assess whether and to what extent the parties concerned complywiththe obligations under this Integrity Pact.

In case of non-compliance of the provisions of the Integrity Pact, the complaint/non-compliance is to be lodged by the aggrieved party with the Nodal Officer only, as shall be appointed bythe MD, NHIDCL. The Nodal Officer shall refer the complaint/non-compliance so received by him to the aforesaid Monitor.

The Monitor will not be subject to any instructions by the representatives of the parties and will perform its functions neutrally and in dependently. The Monitor shall report to the Managing Director, NHIDCL.

The Bidder(s)/ Consultant(s)accepts that the Monitor shall have the right to access, without restriction, all Project documentation of the Principal including that provided by the Consultant. The Consultant will also grant the Monitor, upon his/her request and demonstration of a validinterest, unrestricted and unconditional access to its project documentation. The Monitor is under contractual obligation to treat the information and documents of the Bidder (s) / Consultant (s)with confidentiality.

The Principal will provide to the Monitor, 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 Principal and the Consultant.

As soon as the Monitor notes, or believes to note, a violation of this Pact, he will so inform the Principal and request the Principal to discontinue and/or take corrective action, or to takeotherrelevant action (s). The Monitor can in this regard submit non-binding recommendations. However, beyond this, the Monitor has no right to demand from the parties that they act in a specific manner and/or refrain from action and/or tolerateaction.

The Monitor will submit a written report to the MD, NHIDCL within 4 to 6 weeks from the date of reference or intimation to it and, should the occasion arise, submit proposals for corrective actions for the violation or the breaches of the provisions of the agreement noticed by the Monitor.

If the Monitor has reported to the MD, NHIDCL, of a substantiated suspicion of an offence under relevant IPC/PC Act, and the MD, NHIDCL, has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Chief Vigilance Officer, NHIDCL /MD.

The word 'Monitor' means Independent External Monitor and includesbothsingular and pluralforms.

Section 7 Criminal Consultant(s)/charges against violating Bidder(s) / Subconsultant(s)

If the Principal obtains knowledge of conduct of a Bidder/ Consultant or any employee or a representative or an associate of a Bidder/ Consultant, which constitutes a criminal offence under the IPC/PC Act, or if the Principal has substantive suspicion in this regard, the Principal will forthwith inform the same to the Chief Vigilance Officer, NHIDCL/MD.

Section 8 - Duration of the Integrity Pact

This Pact shall come into force when both parties have legally signed it. The Pact shall expire, in case of the Consultant (s), 3 (three) months after the last payment under the Contract is made and in case of the unsuccessful Bidder(s), 2 (two) months after the contract for the project has been awarded.

If any claims ismade/lodged during this time,the same shall be binding and continue to be validdespitethe lapse of thispact as specified above,unless it is discharged/determined by MD of NHIDCL.

The Bidder(s)/Consultant (s), however, understands and agrees that even upon the completion of the Project and/or the lastpayment under the Contract having been made, if any transgression/violation of the terms of this Pact comes/is brought to the notice of the Principal, it may, subject to its discretion, blacklist and/or exclude such Bidder(s)/Consultant(s) as provided for in Section 3, without prejudice to any other legal right or remedy so available to thePrincipal.

Section 9 - Other provisions

This Agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal, i.e. New Delhi. Changes and supplements as well as termination notices need to be made in writing.

If the Bidder/Consultant is a partnership or a consortium, this Agreement must be signed by all partners or consortiummembers.

Should one or several provisions of this Agreement turn out to be invalid, the remainder of this Agreement shall remain valid and binding. In such a case, the parties will strive to come to an Agreement in accordance to their original intentions.

Wherever he or his as indicated in the above sections, the same may be read as he/she or his/her, as the case maybe.

SIGNED, SEALED AND DELIVERED	SIGNED, SEALED AND DELIVERED
For and on behalf of	For and on behalf of
Executive Director (P) NHIDCL RO-Ladakh	(Authorized Signatory) _____

Witness:

Signature	Signature
Name	Name
Address	Address

Signature	Signature
Name	Name
Address	Address

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS OF 01 x OR LIVING BUNKER (UG)

Brief specification

1.**Scope of Work:-** The work consists of supply & constr of OR living bunker underground of size 15.00 x 5.00 x3.50 mtr (inner dimensions) with height of 3.50m above FFL. Thickness of all walls will be 450mm. and necessary excavation will be carried out.

Toilet :- 1 x toilet of size 3.00 x 2.40 mtr comprising of 2 x urinal ,1x IWC, WHB and shower to be constructed . Retaining wall: - Retaining wall to be designed surround of toilet block for revetment.

Note: - L1 vendor need to submit 3D modeling of bunker with soft copy and hard copy for approval of Accepting officer.

All makes list attached as Appx'A' for ref pls.

2. **Excavation: -** Excavation upto required level to be done by Contractor. Vendor has to confirm the size of excavation incl working space reqd to user unit/respective Engr unit.

3. **Designed and Survey** :- Soil survey to be done before design the UG OR Living structure. All structure incl finishes to be designed by vendor duly vetted from IIT/Govt Engg Collage submit to accepting officer for approval .All designing part to be submitted with T bid only.

4. **(a) AAC Solid Block Steps:-** ACC solid block steps of width 1500mm of 200mm riser and 450mm treads will be provided in entrance over 100mm thick PCC 1:4:8 type D-2 as sub base using 40mm graded crushed stone aggregate and a toe wall of 340mm thick 300mm height over 100mm thick PCC 1:4:8 type D-2 of using 40mm graded crushed stone aggregate. 15mm thick plaster in CM (1:4) will be provided on risers and treads of all steps and door entrance area.

5. **Structural Members:-** All Structure members are to be RCC framed in M-25 design, Mix design report to be submitted with design. Cement to be used OPC 43 Grade of Make att in appx, (i) High strength deformed steel bars produced by thermo mechanical treatment process (TMT steel bars of grades Fe-500 /Fe 500D/Fe550/Fe550D) meeting all other requirements of IS-1786-2000 . The requirement of cement per cubic meter of controlled concrete of grade M-25 shall be as per IS-456 of 2000. The actual requirement of cement for the controlled concrete shall be ascertained by the tests as specified hereinafter. **The design mix for M25 concrete shall be carried out from (NABL/IIT/Govt Engg Collage)** for SEVERE environment conditions and good quality control, l. The tenderer shall ascertain the quantity of cement required and quote the lump sum accordingly. No claim whatsoever arising on account of quantity of actual cement incorporate in the work on account of design mix is admissible.

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

(i) FOSROC Chemicals (India) Ltd.
(ii) Roffe Construction Chemicals Pvt. Ltd.
(iii) STP Speciality Chemicals Ltd.
(iv) CICO Technologies Ltd

TMT 500D bars are to be used in Roof , lintel beams, roof beam, foundation & columns details of reinforcement attached in drgs.

6. **Flooring:-** 40mm thick cement concrete 1:2:4 type B-1 using 20mm graded crushed stone agg over 75mm thick PCC 1:4:8 type D-2 using 40mm graded crushed stone aggregate over 250mm thick compacted soling/hard core mixed with sand complete all as shown in drgs. 3mm thick PVC strip 40 deep to be provided in joints to make a grid in floor of 1.50m x1.50 mtr.

Flooring toilet :- Toilet to be provided with Anti skid ceramic tiles 600mm x600mm x 10mm thick over 15mm screed bed in Cm 1:4 over 100mm PCC 1:4:8 type D2 over rammed earth.

Ramps /Staircase for Entry:- One entry to be provided with ramp with 100mm thick PCC 1:2:4 type B1 over 75mm thick PCC 1:4:8 type D2 over rammed erth in slope of 1:10 . Other Entry to be provided with staircase with PCC block in CM 1:4 and plastering on riser and sides. PCC 40mm thick type 1:2:4 type B0 to be provided over treads

7. **OR Liv Bunker:-** Underground OR living bunker made of AAC solid block masonry in CM 1:4 over PCC foundation.

8. **Steel Door for Entry(02 Nos) to OR living bunker:-** Prefabricated steel door frame made of 14 gauge MS sheet of size 1500 x 1800 mm to be provided with double shutter. Shutter frame will be made of MS angle 50 mm x 50mm x 6mm and FI 25 x 4mm for braces and covered with 2 mm thick MS sheet will be provided. All fixing and locking arrangements like 3 x hinges, 2 x tower bolt, 1 x al drop bolt, 2 x handle will be provided to door. Fabrication of doors shall conform to IS-7452 (1990- 2 Revision) and IS 1038(1983). . The quality of 50 x 50 x 6mm angles/ sheet must be high grade and be sturdier. Quality of welding must be as per IS specified with ISI Mark.

***Note :- Paint Both sides doors shall be painted with two coat of synthetic enamel paint over a coat of red oxide before dispatch and necessary touch up done after delivery if any scratch noticed during delivery by vendor*.**

9. **Entrance Canopy (02 Nos):-** Entrance canopy at the entrance to be provided as per drg. The roof slope shall be 1:5. Roof shall be provided with 0.50 mm thick PPGI corrugated sheet fixed on to the frame work of entrance canopy with using self tapping self drilling (STSD) screws with double washers. PPGI corrugated sheets shall be pre coated pre coloured steel Sand Yellow colour (RAL-1001) pre-profiled sheets with zinc coating 120 GSM conforming to IS-277 (2003) for zinc coating and IS 14246-1995 for steel component shall be used as roof of canopy. The roof will have minimum projection of 300 mm at the end. Both sides shall be covered with 340 mm wide PCC solid block wall up to height 1.95 m from FFL with 15 mm thick internal and external plaster in CM 1:6. Pre fabricated frame for canopy to be of MS angle 35 x 35 x 5 mm with welded plate of size 150 x 150 x 6mm with 4 Nos predrilled holes for fitted on column top plate and column of the canopy are of 40mm MS pipe welded with base plate and top plate of 150 x150 x 6mm with 4 Nos predrilled holes to be fitted with 16mm dia 50mm long for top plate and 16 mm dia 300 mm long nut/bolts (fdn bolt) with double washer for base plate will be fitted over a PCC 1:2:4 type B-1 block of size 200x200x300mm. Fixing of the joints by nut/ bolts and plate of 6mm thick (appropriate size) to be welded with each member of the joint, min four nut and bolts to be fixed with each joining place at joints. Canopy to be painted with two coat of synthetic enamel paint over a coat of primer. Colour will be sand Yellow colour (RAL-1001).

(a) 2 Nos x 50mm dia MS pipe 1.80M long 3mm thick bunker side 40mm dia MS pipe 1.80M long 3mm thick at end welded with base plate and top plate of size 150x150x6mm with 4 Nos predrilled holes (Total 04 Nos of MS Pipe).

(b) 10mm dia 50mm long nut bolt with double washer (16 Nos).

(c) 16mm dia 300 mm long nut/ bolt (fdn bolt) with double washer (16 Nos).

(d) Top frame for canopy to be of MS angle 35 x 35 x 5 mm as per drg. (01 Nos).

(e) PPGI corrugated sheets 0.5 mm gauge 2400 x 1080mm (03 Nos)

(f) 0.50 mm thick GI plain sheet of size 2400 x 600 mm for entrance canopy ridge/gable side cover(04 Nos)

(g) 8mm dia 25mm long self taping screw/bolt, nut with double washer (50 Nos)

(h) PCC 1:2:4 type B1 using 20mm graded aggregate to be done in foundation of canopy with size of concrete block 300 x300x 450mm deep incl necessary formwork.

Retaining wall: - Excavated area of FSC to be retained with retaining wall as drg attached.
Bond stone: - PCC 1:3:6 bond stone to be provided to through out width two in each Sqm.
Pointing: - All exposed surface of retaining wall to be Raised pointing in CM 1:3.
Weep holes: - Weep holes 150mm x150mm wide to be made at ever 1 Sqm with PVC double wall pipes.
Back filling:- Boulder pitching, laid dry, hand packed tightly as back fill of retaining wall .

10. **Wall Plastering:-** All walls from internal to be plastered with 10mm thick CM 1:6 and externally plastered 15mm thick with Cm 1:4 .

Wall Panels (Internal/External):- All walls shall be made of GI metal skin PUF panels. PUF shall be 60 mm with density 42 Kg/Cum. The PUF insulation material in the panel shall have fire retarding and self-extinguishing properties as per international standard. There should not be any gap between PUF wall panels and wall and roof by provision of suitable joining arrangement. Other details of wall panels are as follows.

(a) All material required for the manufacture of shelter shall be new and shall comply with relevant Bureau of Indian Standard Specification.

(b) These panels are to be manufactured using high pressure dispensing machine of required capacity to inject specified amount of PUF chemical into the cavity of a full panel in one shot not exceeding 25 sec duration. This is to ensure that the liquid PUF mixture is sprayed into the cavity before the foaming reaction starts so that the insulation core of the panel is formed in one continuous piece and provides desired structural and physical properties. The bulk density of PUF insulation should be 42 Kg/Cum from CFC free close cellpolyurethane foam and the dispensing machinery should be kept with a PLC controlled panel for monitoring and controlling the injection rate to assure specified uniform density requirements. The total thickness of the finished composite panel should be 61 mm. The tolerance in the panel can only be on the plus side.

(c) The outer and inner colour coated (RAL-1001) GI skin made from hot dipped galvanized steel of the panels should be 0.50 mm thick TCT (Total coated thickness).Each panel should be supplied pre-painted with a colour coating of 50 microns of architectural polyester on a minimum 120 gms/m² base of Zinc coating on the finished surface only for protection against scratches during handling and transportation. Base metal of GI skin CRCA should be as per IS-513-2008 and grade of zinc coating will be 120 GSM as per IS-277-2003.

(d) The pre-coated GI sheet skin should have min coating of 4.5 micron epoxy primer and 25 micron polyester top coat on the finished surface and 7-8 micron primer Alkyd Backer on backside which is bounded to the polyurethane foam. The pre coated GI sheet should conform to IS 14246-2013 with manufacturer test certificatesconforming to specification.

(e) The PUF insulated core of these composite panels should have the following properties :-

(i) Density-42Kg/Cum.
(ii) Panel wt should be min 11 Kg/m³.
(iii) 'U' value of external walls will not exceed 0.36 /m2K.
(iv) Flammability – B2 DIN 4102 Part-I.
(v) Blowing Agent (non CFC) – R-141B.
(vi) External colour of PUF panel would be sand colour (RAL-1001) &inner colour would be off white.
(vii) Compressive Strength At 10% deformation - 2.1 kg/cm².
(viii) Tensile Strength - 3.7 kg/cm².
(ix) Bending Strength - 4.0 Kg/cm².
(x) Adhesion Strength (Foam to Steel) - 2.9 Kg/cm².
(xi) Close Cell Content - 90-95%.

(f) 2 mm thick MS sheet 'C' channel of size 75mm x 40 mm atthe bottom (Floor level) and top shall be provided to slide and fit the wall panels. Suitable arrangements will be made to fix the C channel to floor at bottom and on top to structural members.

(g) **PUF Panel Joining arrangement:-** All composite panels will be provided with metallic tongue & groove joints and suitable number of cam locks as specified here-in-after which are fixed in place during the in-situ process itself. The placing of cam-lock should be eccentric and such that a 2.7m long x 1.2m wide wall panel should be provided with 3 pairs of cam locks on the vertical joints. The holes in the panels for operating the cam locks shall be provided with PVC caps for sealing the holes after installation. The cam locks shall be fixed with GI sheet metal skin of PUF panels by means of suitable size screws / rivets. The joining arrangement of two PUF panels with each other and fixing arrangement of CAM locks with GI metal skin of PUF panels will be all as per shown in drawing No 7 & 8 respectively.

(h) The panels should be moulded in place using the above in-situ process after placing them in a hydraulic press with heated aluminum anodized pattern and corner mould so as to attain the desired finish, bonding and structural properties.

(j) All panels will be manufactured in continuous single piece as per approved panel layout drawing using

the above materials and manufacturing process. A spare panel will be supplied along with bulk supply of panels for testing the designed parameters of the incorporated panels in the shelters Continuous

(k) The purchaser can get quality testing of any panel from the lot supplied to ensure quality control as per given specifications. Cost of quality testing will be borne by the supplier.

(l) The corner 'L' shaped flashing shall be fabricated and supplied in single piece of 'L' Shape off white colour of size 300 mm on inside of bend without any joint. An additional flashing of 0.50mm thick size 300mm PPGI sheet of same colour as of outside wall will also be provided on joints of 'L' panel with the help of rivets.

Note :- Necessary support and plugging to wall for erection of puff panel including in cost of shelter.

Finishes :- All plaster surface to be finished with three coats of white wash/approved colour shade.

Drain:- Over ground drain to be provided all round to the Amn Bunker with 30cm girth in PCC 1:2:4 type B1 using 20mm graded stone aggregate with internal plaster in CM 1:3. The size of drain is 300mm wide 300mm avg depth and 100mm thick over 150mm thick stone soling.

OHP (Over head protection):- 1200mm earth fills to be done over RCC roof as OHP.

Roof treatment :- a) Priming surfaces and applying normal treatment for moderate conditions 1.5Kg/Sqm

b) APP based polymeric membrane minimum weighing 3kg/sqm and minimum 3mm thick reinforced with polyester non- wove fabric (wt. not less than 150 gms/sqm) land on primed surface by forced application complete all as specified.

c) 2 coat of waterproof silver paint to be provided over APP.

d) The number of laps shall be minimized by selecting film of suitable width and laying it as specified here-in-after. The minimum width of laps shall be 10cm between adjacent membranes and at the end.

The contractor will submit original purchase voucher along with the test certificate for each consignment/lot of material brought at site**.**

12. **Fire Extinguisher 2 Kg:-** Supply of 2 Kg capacity of fire extinguisher (two Nos) ABC powder type filled with MAP (mono ammonium phosphate) dry powder, suitable for all types of fire, operating temperature -300C to +550C, working pressure 15 Bar, average discharge time 11 sec, discharge rating more than 2 mtrs, electrically nonconductive, environment-friendly, extremely low in toxicity and exceptionally conforming to IS 15683 (2006) along with its accessories.

13. Details missing, if any will be assumed to be provided by the supplier as per good engineering practice and will be approved by inspection team of consignee. Whenever there is variation between drawing and technical specification, technical specification are to be followed.

14. **Mini Lightning Conductor:**- 01 x set Lightning Conductor made of Copper Tube 150 cm long x 25 mm dia with five copper prongs of length 15 CM each fixed to copper ball of dia 50mm and 4mm thick with securing arrangement. GI plate of 40cm x 40cm x 3mm will be provided for earthing purpose. 30cm long insulation of insulating material capable of insulating the lightening conductor pipe from the roof of shelter will be provided on the copper tube of lightening conductor. Necessary porcelain insulated MS clamps for fitting copper tube & copper conductor, 25 kg wood charcoal granules size not less than 10 mm (in HDPE bags), 25 kg edible rock salt granules (in HDPE bags) with man hole cover of size 45cm x 45cm over PCC pit of inner size 30cm x 30cm x 30 cm deep with 7.5 cm concrete wall thickness will be provided and GI funnel fixed with 20mm dia GI pipe upto 1.0 mtr depth. The depth of earthing pit will be 2.25 m deep below GL. Aluminum conductor strip connecting copper tube and GI earth plate will be 25mm x 3mm thick with rubber insulation including necessary fixing clamps with walls. Termination point with 15 cm long aluminum strip 25mm x 3 mm thick having holes at both ends for fixing aluminum conductor strip from earth plate and copper tube from roof with the help of suitable size nut & bolts will be made at plinth level to check the resistance of the earthing.

15. **Solar light:-** 10 No x Supply of Multi Purpose Solar Light powered by LEDs with strong ABS body complete with solar panel and AC charger as per the following specifications :

(i) Energy backup :

(aa) 4-6 hrs on solar light at max brightness.

(ab) 8 hrs on AC charging.

(ii) Multi utility for use as torch light, ceiling light, wall light, reading light and charging of mobile.

(iii) Two charging modes - Solar energy and AC power.

(iv) On/Off switch and battery indication.

WATER STORAGE TANKS (01 Nos):- Installation of 1000 ltr Puff tanks into position shall be carried out with proper take care being taken that no part of the tank or of the structure is damaged in the operation. The tanks shall be installed underground with structure, unless otherwise directed. The joints or connection to pipes shall be PPR pipe with 25mm nitrile pipe and properly insulated that water supply untapped during winter also.

MS Frame :- Mild steel frame for installation of tank also part of water supply .The frame to be maid in 65 x65 x8mm angle iron with height 15 feet.

Toilets: - Toilets as size mentioned above to be provided with under mentioned specification.

Att toilets – EWC -01,Shower-01, Urinal -02, WHB -01,Flushing cistern-01,looking mirror-01

Note: - all connected accessories to be incl during design.

a) Sanitary appliances of Stainless steel shall be of first quality and confirm to ISfor General requirements and the specific requirements.

b) 'P' and or 'S' trap shall be cast iron and jointed to WC pan with cement joints.

c) All water tubing shall be PPR with 25mm insulation of nitrile rubber conforming to IS 1239 and fittings shall comply with the requirement of relevant IS.

d) Make of sanitary & hardware attached in appx.

e) 01 x 1HP motor to be provided for filling of water in tanks.

Fire/ Smoke Alarm:- Carbon Monoxide Based Smoke Alarm with the following specification :-

(a) Electrical rating: 9V DC battery powered.

(b) Operating temperature: (-100C to 380 C).

(c) Detection: Dual Ionization Chamber.

(d) Horn Out Put: 85 Decibels at 10 Feet.

(e) Humidity: 10% to 93% relative Humidity.

(f) Product weight: 4-6 Ounces.

(g) Electrical Rating: 9V DC battery powered (2 Nos pares).

Sewage Disposal :-

a) All soil, waste, vent pipe, their fittings and accessories shall be of PVC 110mm double wall and shall bear ISI marking.

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

Septic tank/Soakage wll :- 1 x septic tank/soakage well of size 3.00 x1.80 x 2.00 mtr depth (inner dimensions), wall thickness 0.45mtr will be constructed with RR Stones with baffle walls, inspection chamber & 110m PVC vent pipe with cowls,

c) Septic tank suction machine to be provided 500 ltr cap.

Construction Materials Instruction:-

Cement:-

a) Cement shall be stored in covered go down over dry platform at least 20 cm high in such a manners as to prevent deterioration due to moisture or intrusion of foreign matter. In case of store room the stack should be at least 20cm away from floors and 60cm from walls. The stacking of cement shall be done as specified in relevant IS.

b) Cement shall meet strength criteria of 43 grade OPC as laid down in IS 8112-1989(2003)

c) Cement used not more than two month old for construction.

d) Fine aggregate (sand) for concrete work/masonry/plastering work shall conform to materials specifications and grading within the limits of grading Zone I to III as specified in IS 383 2016.

e) Coarse aggregate (stone aggregate) for all cement concrete work such as PCC/RCC shall be of approved quality all as specified in IS code 838-2016. Mixture of two types of stones shall not be permitted.

Work test shall be conducted as per clause 15 of IS-456 of 2000. At the commencement of the concreting, samples of concrete shall be taken on each day as specified in clause 15 of IS-456 of 2000 and specimens made at the work site out of the concrete being used in the works, for the purpose of testing compressive strength. From each of these samples, 7 test cubes of size 150 x 150 x 150 mm shall be taken to test 3 specimens at 7 days and 3 specimens at 28 days in Unit laboratory. Job No., date of casting and location where concrete is being used shall be marked on each concrete cube.

Structural steel :-

a) Structural Steel standard quality shall be used for structures. The steel shall conform to IS-2062-2011 (sixth revision). Contractor shall be responsible for proper storage, preservation and maintenance of steel at site till it is consumed in the work. Steel rejected shall be stacked separately.

b) All MS Black, Bolts and nuts shall conform to IS: 1353 part I to III of 1984 and round washer shall conform to IS: 5370, IS: 5372 or IS: 5374 where ever specification are not available. The round washers shall be placed under the heads and nuts of permanent bolts. Minimum two washers for one nut and one for each bolt head shall be used. Bolts threads shall be out side limit of jointing members and unthreaded portion of bolt shall not be out side the washer.

Flooring :-

a) Cast in situ PCC floor topping shall be laid in panels as per clause os IS codes. The pattern/layout of panels in rooms shall be as directed of Accepting officer.

b) Plastic dividing strips shall not act as form work separate formwork for PCC should be provided .Cost of same incl in cost of shelter.

PLASTERING AND POINTING:-

a) Any other plaster in internal/external surfaces of wall not specified on drawings and/or in these specifications shall be as mentioned in TS will be finished fair and even.

b) All corners, angles, junctions and edges unless otherwise specified shall be truly vertical or horizontal as the case may be and shall be carefully finished.

LAYOUT PLAN:-

a) Locations of Bldgs/shelter/Drainage/light fittings/socket outlet, main switches and DBS are approved by accepting officer before execution. Vendor need to submit all daft sketches to accepting officer for approval.

Site Guidelines:-

a) **VISIT TO SITE WITHIN THE RESTRICTED AREA:-** Permission to enter the restricted area(s) at time of submission of tenders can be obtained, through the Accepting officer. Vendor are advised to send prior intimation to the Accepting officer about the particulars of the agents, representative etc., if any, the date and the time of their proposed visits so that necessary arrangement may be made by the Accepting officer, to secure admission. Whether tenderers visit the site or not they shall be deemed to have full knowledge of the restrictions on entering in, exit from and working within the restricted area.

b) **The contractor**, his agents and representatives are required individually to be in possession of an identity card or pass duly issued by Govt/User unit/Accepting officer.

c) **WORKING HOURS:-** The units controlling restricted area, The working hours available to contractor's labour/staff shall however accordingly get reduced because of the time taken in security checks observed at the time of entry and exit and during working hours. The exact working hours, working days and non working days observed for these restricted area(s), where works are to be carried out shall be deemed to have been ascertained by contractor before submitting his Bid.

d) **FIRE PRECAUTIONS:-**

(i) The contractor, his agents, representatives, workmen etc., shall strictly observe the orders pertaining to fire precautions prevailing within the restricted area.

(ii) Motor transport vehicle, if allowed by the authorities to enter the restricted area must be fitted with serviceable fire extinguishers.

e) Contractor shall employ only Indian Nationals as his representatives, servants and workmen after verifying their antecedents and loyalty. He shall ensure that no person of doubtful antecedents and nationality is, in any way, associated with the work. If for the reasons of technical collaboration or other considerations the employment of foreign national(s) is unavoidable, the contractor shall furnish full particulars to this effect to the Accepting Officer at the time of submission of the Bid.

f) LOCATION OF BUILDINGS AND WORKS:- There may be some changes in location/sitting of building shown in site (layout) plan (s) to suit local conditions and /or departmental requirements. The contractor shall have no claim what-so-ever consequent to such change in the location/sitting of works.

g) Technical Manpower:- The Vendor is required to estimate the requirement of skilled / unskilled manpower for execution of the Work and submit the same for approval within 15 days after placement of Supply Order. Once approved, availability of the subject manpower will be ensured by the vendor. Necessary documentation for entry of manpower to restricted area will be completed before commencement of work.

h) Tools, Plants and Operators:- The Vendor is required to estimate the requirement of Tools, Plant and other construction equipment required (along with fuel required for the same) for execution of the Work and submit the same for approval within 15 days after placement of Supply Order. Once approved, the Tools, Plant, Construction equipment (along with fuel & spares for the same) and qualified technical manpower and operators for operating these will be provided by the vendor.

i) Electric & Water Supply:- Vendor may take electric/ water connection from nearest available electric/ water point after due permission from concerned authorities. Electric/ water supply shall be supplied through Meter. Vendor shall make necessary arrangement for fixing of electrical/ water meter at prevailing market rates. The Electric/ water bills shall be deposited by the vendor directly to concerned authorities. The vendor may provide suitable Generator at site for progress the work. Vendor shall make his own arrangement for water supply at work location.

Electricals:- Internal electrification of the shelter shall be carried out all as per the approved make for the respective items in Annx-I and shall be ISI mark.

Bukharies : Installation of Oil bukharies with complete acesseries with ventilation (02 NOs for each OR Liv Buker

PART-III
TECHNICAL SPECIFICATIONS OF 01 UG TAC HQ

Brief Description

1. Supply and constr of Under ground Tac HQ of size 20.00 mtr x 5.00m x 3.50 with RCC framed construction M-25,Super structure in AAC block, joinery UPVC sliding doors & windows, UPVC vents center hung type.,Staircase, Toilet facilities ,Drainage & Retaining wall as per Line drg attached for ref.

a) CDR office – 3.80 x 3.00 mtr (internal dimn)
b) OPS room – 6.00 x3.80 mtr (internal dimn)
c) Dy CDR room – 2.80x 3.80 mtr (internal dimn)
d) G Office - 3.00 x 3.80 mtr (internal dimn)
e) AQ office - 3.00 x 3.80 mtr(Internal dimn)
f) GD & Sentry post – 2.20 x 3.80 mtr (Internal dimn)

2. <u>Design Parameters.</u>

(a)	UG Tech HQ		
(i)	Length	-	20.00 M.
(ii)	Width	-	5.50 M.
(iii)	Height	-	As per arch drg.
(iv)	Seismic zone	-	Zone V.
(v)	Wind Speed	-	55 Meter / second.
(vi)	Bay Spacing	-	As per design.
(vii)	Wind bracing	-	As per design.
(viii)	Snow load	-	1.5 feetr on roof

(*To be confirmed at the time of submission of design before Technical bid*)

(ix) Wind load - Equivalent to wind speed of 55 mtrs/sec as per IS-875 (2015)
(x) External temperature - (-) 400C to + 350C.
(xi) Water absorption/Penetration – Nil
(xii) Termite proofing - Termite proof.
(xiii) Item to be - Fire retardant & should not emit toxic fumes.
(xiv) Design load - As per IS 875-2015.
(xv) OHP -1200mm Earth filling on roof

<u>Excavation: -</u> Excavation upto required level to be done by user unit. Vendor has to confirme the size of excavation incl working space reqd to user unit.

<u>Designed and Survey :-</u> UG Tac HQ soil survey, Geographical survey to be done before design the structure. All structure with finishes to be designed by vendor and after approval from IIT/Govt Engg Collage submit to accepting officer for approval. All designing part to be submitted with T bid only.

3. **<u>Structural Members:-</u>** All Structure members to be RCC framed in M-25 design ,Mix design report to be submitted with design. Cement to be used OPC 43 Grade of Make att in appx, (i) High strength deformed steel bars produced by thermo mechanical treatment process (TMT steel bars of grades Fe-500 /Fe 500D/Fe550/Fe550D) meeting all other requirements of IS-1786-2000 . The requirement of cement per cubic meter of controlled concrete of grade M-25 shall be as per IS-456 of 2000. The actual requirement of cement for the controlled concrete shall be ascertained by the tests as specified hereinafter. The design mix for M25 concrete shall be carried out for SEVERE environment conditions and good quality control, l. The tenderer shall ascertain the quantity of cement required and quote the lump sum accordingly. No claim whatsoever arising on account of quantity of actual cement incorporate in the work on ac- count of design mix is admissible.

(a) Contractor shall use liquid admixtures (Super plasticizers) to achieve the workability and to reduce the water content in design mix. Admixtures shall confirm to IS 9103: 1999 shall be from approved manufacturers

as given below: -
(i) FOSROC Chemicals (India) Ltd.
(ii) Roffe Construction Chemicals Pvt. Ltd.
(iii) STP Speciality Chemicals Ltd.
(iv) CICO Technologies Ltd

Super Structure:- The AAC (Autoclave aerated concrete block)shall use of size 45cm x 30cm x 20cm and fulfill to IS code 2185-1984 (Reaffirmed 2005) of Grade M-20 strength. With having density 1000kg/Cum,Good thermal conductivity, less dry shrinkage
Testing of AAC block:- Testing of AAC block to be done as per norms mentioned in IS 2185 (2005).

Retaining wall :- Excavated area of FSC to be retained with retaining wall as drg attached.
Bond stone :- PCC 1:3:6 bond stone to be provided to through out width one in each Sqm.
Pointing :- All exposed surface of retaining wall to be Raised pointing in CM 1:3.
Weep holes :- Weep holes 150mm x150mm wide to be made at ever 1 Sqm with PVC double wall pipes.
Back filling:- Boulder pitching, laid dry, hand packed tightly as back fill of retaining wall .

Plastering :-
(a) All external plaster shall be carried out in CM 1:4 below ground level except where steps, ramps, plinth protection and shaft/passage with PCC are provided.
(b) Plaster and skirting/dado shall be provided in jambs, soffit of lintels and window cills etc.
(c) 15mm thickness of plaster shall be finished thickness exclusive of dubbing.
(d) Any other plaster in internal/external surfaces of wall not specified on drawings and/or in these specifications shall be 15mm thick in CM (1:6) finished fair and even.
(e) All corners, angles, junctions and edges unless otherwise specified shall be truly vertical or horizontal as the case may be and shall be carefully finished.

(f) Sand for plastering/pointing work shall conform to the materials, specification and grading as per IS 383 - 2016

Flooring :-
a) Vitrified tiles shall be of first (Premium) quality with rectified edges and of shade as directed by accepting officer. Make of tiles shall be all as specified and approved by accepting officer. The size of tiles shall be 1200mmx600mm, 10mm thick over 15mm screed bed in CM 1:3.

(b) PCC 1:4:8 type D2 using 40mm graded aggregate to be laid as sub base over 150mm hardcore n exc 63mm.

Painting: - Weather proof exterior emulsion paint shall be applied in two coats over a coat of primer as per the manufacturer's instructions. Plastered surfaces shall be prepared by applying a layer JK/Birla white putty not less than 2 mm thick before applying emulsion paint. However special care shall be taken to workmanship for strict compliance of instruction of manufacturer to obtain best results of product used in the work. Makes/brand of weather proof paint shall be as mentioned in Approved List of Makes.
(i) fungus/Moss/Algae affected surface on new or old surfaces, remove fungus growth if any antifungal treatment or with the help of available fungicide bleaching powder solution all as per manufacturer's instructions. The surface shall be cleaned by wire brushing and washed before application of primer or paint.

(ii) The acrylic emulsion weather coat paint shall be applied by brush or roller. Paint shall be of approved shade ready to use in a manufacturer's sealed container of 20/10 or 4 Ltr packing. No strainer or colorants shall be used. The paint shall be stirred well before use.

(iii) Application of Acrylic emulsion weather coat paint. One coat of acrylic emulsion weather coat paint thinned with water all as instructed by the manufacturer shall be applied. The drying period between two coats

shall be minimum 6 hours or as per manufacturer's instructions. The shade shall be as approved by accepting officer. Finish of acrylic emulsion weather paint shall be smooth matt finish.
(iv) The paint shall be as per manufacturer's original colour as available no mix of tint shall be made into original shades.

WATER STORAGE TANKS (04 Nos):-

Installation of 500 ltr Puff tanks into position shall be carried out with proper take care being taken that no part of the tank or of the structure is damaged in the operation. The tanks shall be installed underground with structure, unless otherwise directed. The joints or connection to pipes shall be PPR pipe with 25mm nitrile pipe and properly insulated that water supply untapped during winter also.

MS Frame :- Mild steel frame for installation of tank also part of water supply .The frame to be maid in 65 x65 x8mm angle iron with height 15 feet.

Toilets :- Toilets as size mentioned above to be provided with under mentioned specification.

a) Att toilets – EWC -01, Urinal -01, WHB -01, Flushing cistern-01, looking mirror-01

Note: - all connected accessories to be incl during design.

b) Sanitary appliances of vitreous china shall be of first quality and confirm to IS-2256 for General requirements and the specific requirements.

c) 'P' and or 'S' trap shall be cast iron and jointed to WC pan with cement joints.

d) All water tubing shall be PPR with 25mm insulation of nitrile rubber conforming to IS 1239 and fittings shall comply with the requirement of relevant IS.

e) Make of sanitary & hardware attached in appx.

Sewage Disposal :-

a) All soil, waste, vent pipe, their fittings and accessories shall be of PVC 110mm double wall and shall bear ISI marking.

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

Septic tank: - 1 x septic tank of size 3.00 x1.80 x 2.00 mtr depth (inner imensions), wall thickness 0.45mtr will be constructed with RR Stones with baffle walls, inspection chamber & 110m PVC vent pipe with cowls, septic tank covered with 5mm MS cover and support to be made in 65 x65 x6mm angle iron incl suction pipe and HP monoblock pump of electric connection to be provided.

False Celling :-

a) Anodised aluminium snap grid frame work for false ceiling with hangers 6 mm dia. G.I. (upto 1200mm length) adjusting level fixed to roof slabs by means of ceiling cleats made out of G.I. flat 40 x 3 mm size 60mm long and expansion hold fasteners 12.5mm dia. 40mm long.

b) 12mm thick Seamless calcium silicate ceiling made out of 1800 x 1200 mm size board of siliceous and calcareous material reinforced with cellulose fibre fixed to the ceiling section with 25 mm long self drilling and tapping screws having Phillips head with under head cutter at 200 mm centre to centre, including finishing the joint of face board with specially formulated jointing compound and 48 mm wide fibre tape to provide seam less finish.

Joinery :-

a) Providing and fixing factory made 2mm thick uPVC frame white colour casement/sliding window/Sliding door, made of extruded profiles. Profiles of frames and sash will be mitered cut and fusion welded at all corners, including drilling of holes for fixing hardware and drainage of water etc.. making arrangement for fixing of hardware, EPDM gasket, 1.2+ 0.2.mm thick galvanized steel profile to be inserted in required profile, frame will be fixed to the wall with 8mm x 100mm long fasteners, all complete and as directed, (Glazing, hardware hinges and fitting, EPDM rubber gasket.

b) Providing and fixing factory made uPVC white color Sliding window size 1.20 x1.20 mtr Two track made of extruded profiles with wall thickness of 2.3mm (+- 0.2mm). Window profile with hollow section with multi

chamber, Frame (60mm x 62mm). sash (42mm x 67mm). Sliding Interlock (One vertical length in each shutter) (45.5mm x 28mm). Glazing bead (24.5mmx 16mm) will he mitered cut and fusion welded at all corners, including drilling of holes for fixing hardware and drainage of water etc. making arrangement for fixing of hardware. EPDM gasket 1.2 + -0.2mm thick galvanized steel frame (30mm x 21.5mm), Sash (30mm x 18mm), profile to be inserted in required profile, frame will be fixed to the wall with 8mm x 100mm long fasteners. Hardware : [Touch Lock of zinc alloyed (white powder coated), steel roller system including 5mm thick glazing with selected quality glass, aluminum track on bottom rail for two track sliding frame, wool pine for Sliding sash and interlock.

c) Supply and fixing factory made uPVC white colour fixed glazed window/ventilator made of (small series) frame 800 x 600 mm mullion 770 x 580 mm both having wall thickness of 1.9 ± 0.2 mm and single glazing bead of appropriate dimension (Area upto 0.75 sqm.) comprising of uPVC multi-chambered frame and mullion (where ever required) extruded profiles duly reinforced with 1.60 ± 0.2 mm thick galvanized mild steel section made from roll forming process of required length (shape & size according to uPVC profile), uPVC extruded glazing beads of appropriate dimension, EPDM gasket, G.I. fasteners 100 x 8 mm size for fixing frame to finished wall, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame shall be mitred cut and fusion welded at all corners, mullion (if required) shall be also fusion welded including drilling of holes for fixing hardware's and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of required size.

d) Supply and fixing factory made uPVC white colour Two track four panels sliding glazed door size 3.00m x 2.10 mtr made of (big series) frame 67 x 50 mm & sash 46 x 82 mm both having wall thickness of 2.3 ± 0.2 mm and single glazing bead/ double glazing bead of appropriate dimension. comprising of uPVC multi-chambered frame, with in-built roller track and sash extruded profiles duly reinforced with 1.60 ± 0.2 mm thick galvanized mild steel section made from roll forming process of required length (shape & size according to uPVC profile), appropriate dimension uPVC extruded glazing beads, uPVC extruded interlock and uPVC extruded Inline sash adaptor (if required), EPDM gasket, wool pile, zinc alloy (white powder coated) handle with key on one side of extreme panels along with zinc plated mild steel multi point locking having transmission gear with keeps, zinc alloy (white powder coated) cresent lock (if required), stainless steel (SS 304 grade) body with adjustable double nylon rollers (weight bearing capacity to be 120 kg

e) Supply and fixing factory made uPVC white colour Two track four panels sliding glazed door size 1.50m x 2.10 mtr made of (big series) frame 67 x 50 mm & sash 46 x 82 mm both having wall thickness of 2.3 ± 0.2 mm and single glazing bead/ double glazing bead of appropriate dimension. comprising of uPVC multi-chambered frame, with in-built roller track and sash extruded profiles duly reinforced with 1.60 ± 0.2 mm thick galvanized mild steel section made from roll forming process of required length (shape & size according to uPVC profile), appropriate dimension uPVC extruded glazing beads, uPVC extruded interlock and uPVC extruded Inline sash adaptor (if required), EPDM gasket, wool pile, zinc alloy (white powder coated) handle with key on one side of extreme panels along with zinc plated mild steel multi point locking having transmission gear with keeps, zinc alloy (white powder coated) cresent lock (if required), stainless steel (SS 304 grade) body with adjustable double nylon rollers (weight bearing capacity to be 120 kg

f) Glazed :- All dorrs/windows/vents to be double galzed with 5mm toughened glass with neoprene/gasket/beadings.

Roof treatment :-

a) Priming surfaces and applying normal treatment for moderate conditions 1.5Kg/Sqm

b) APP based polymeric membrane minimum weighing 3kg/sqm and minimum 3mm thick reinforced with polyster non wove fabric (wt. not less than 150 gms/sqm) land on primed surface by forced application complete all as specified.

c) 2 coat of waterproof silver paint to be provided over APP.

d) The number of laps shall be minimized by selecting film of suitable width and laying it as specified here-in-after. The minimum width of laps shall be 10cm between adjacent membranes and at the end.

e) The contractor will submit original purchase voucher along with the test certificate for each consignment/lot of material brought at site

Curtain Rods:- All openings of doors / windows of shelter excluding verandah openings will be provided with drapery rods made of 25mm dia, SS of 1.5mm thickness. A pair of suitable fixing brackets of curtain rod with wall panels and 10 Nos plastic rings of matching shade with each curtain rods of suitable size will be provided. The curtain rods shall be fixed such that the rod is minimum 75mm away from the wall panels and overhang (projection) – 200mm each on both sides. Brackets will be fixed with nut and bolt with washers out to out of panels. (Makes: Ajanta/Bharat/Classic/ Décor or 14 Corps approved)

Quality Control:- Accepting officer is to get all parts/any part checked for quality confirmation as given in the technical specification. Cost of testing will be borne by the supplier.Vendor has to submit all PVs,,testing of material incl OEM cert & OEM authorized cert before payment.

Iron Boot Scrapper:- Iron foot scrapper of size 500mm x 500mm qty two (for each shelter) will be provided for living entrance doors as per drawing.

Soakage Well:- 2 x soakage well of size 1.5m x 1.5m (inner dimensions), wall thickness .38m square in shape and 3m depth (from top to bottom) will be constructed with RR Stones with adequate Nos of honey combing, overhead protection of earth 0.45m to 0.60m in height will be provided above ground level of soakage well to help the anti-freezing of soakage well

Soakage Pit Cover:- 2 x Soakage pit cover of size 2.00m x 2.00m. The frame of soakage pit cover will be made of 50mm x 50mm x 6mm thick MS angle as per design details attached. The frame to be covered by MS sheet of 1mm thickness and of size 2.00m x 2.00m. The MS sheet will be welded with frame using F1 4mm x 300 as per good engineering practice. Details are given at drawing att.

Lightening Conductor and Earthing:-

(a) **Lightening Conductor:-** Lightening Conductor made of copper Tube 150 cm long x 25 mm dia with five copper prongs of length 15 cm each fixed to copper ball of dia 50mm and 4mm thick with securing arrangement. Bottom 40 cm portion of the copper tube will be covered with PVC insulating material to avoid direct contact between the building and the lightening conductor. GI plate of 60cm x 60cm x 3mm will be provided for earthing purpose and will be placed 2.5 m below GL. GI plate and copper conductor will be connected by using 4mm dia GI conductor wire. GI conductor wire will pass through PVC conduit pipe to avoid direct contact between building and GI wire. Necessary insulated MS clamps for fitting PVC conduit pipe with building will be provided. For effective earthing of the struck lightening, moisture near GI plate needs to be maintained. Moisture will be maintain by covering GI plate with 15cm alternative layers of Salt and Charcoal as per details given in the drawing attached. Two GI funnel fixed with 20mm dia GI pipe of length 1.5 m will be provided for passing GI conductor wire and supplying water at 2.5 m depth. Man hole will be covered by using PVC cover of size 45cm x 45cm over PCC pit. 15 cm long Termination point copper strip of size 25mm x 3mm having holes at both ends for fixing GI conductor wire coming from copper tube and GI plate with suitable nuts and bolts, will be provided at plinth level to check the resistance of the earthing. Schematic layout of lightening conductor is as per drawing att.

(b) **Earthing of Building:-** Earthing of building will be carried out by connecting Main Electrical Board with GI earth plate of 60cm x 60cm x 3mm with the help of 4mm dia GI wire. GI earth plate of 60cm x 60 cm x 3mm will be placed 2.5 m below ground level. GI conductor wire will pass through PVC conduit pipe to avoid direct contact between building and GI wire. Necessary insulated MS clamps for fitting PVC conduit pipe with building will be provided. For effective earthing of the struck ightening, Moisture near GI plate needs to be maintained. Moisture will be maintain by covering GI plate with 15cm alternative layers of Salt and Charcoal as per details given in the drawing attached. Two GI funnel fixed with 20mm dia GI pipe of length 1.5 m will be provided for passing GI conductor wire and supplying water at 2.5 m depth.

Man hole will be covered by using PVC cover of size 45cm x 45cm over PCC pit. 15 cm long

Termination point copper strip of size 25mm x 3mm having holes at both ends for fixing GI conductor wire coming from copper tube and GI plate with suitable nuts and bolts, will be provided at plinth level to check the resistance of the earthing.

Almirah steel large (Half hanging & half shelf):-

(21 Nos per Shelter) (Makes: Godrej/Feather Lite/Antique). The specification will be as under :-

(a) External colour – Light Grey colour on doors of the Almirah & Light grey colour on the sides, top & back side of Almirah.

(b) Mode of painting – Two coat of powder coated synthetic enamel paint over one coat of metallic primer by using spray gun .Before the painting work the surface of Almirah and Cupboard be dried at 1800C to avoid moisture content overdue surface.

(c) Internal - Light Grey colour.(To be approved during pilot sample inspection)

(d) External Dimension. (Total incl clearance of 100mm from ground) :-

(i) Height - 1830mm.
(ii) Width - 485mm.
(iii) Length - 920mm.
(iv) It will have two partitions of equal size with a separate in built locking arrangement

(e) The thickness of sheet shall be as under: -

(i)	Side, Top & Bottom	-	18 gauge
(ii)	Rear sheet	-	18 gauge
(iii)	Partition	-	18 gauge
(iv)	Door	-	20 gauge
(v)	Shelves	-	18 gauge

(f) Internal Dimension. No of shelves to be provided are :-

(i) Space from the top on both sides upto 1000mm downwards & 460mm wide along the length side for hanging clothes with a rod.

(ii) Three shelves in both partitions below the 1.0m with clear space between shelves as 276mm. The thickness of sheet to be used for partition will be 1mm.

(g) Ten No hangers will be supplied with each almirah.

Fire Extinguisher:-

Supply of fire extinguisher Powder type and balll type conforming to IS:13849-2010 along with its accessories.

(a) 2 Kg
(b) 5 Kg

Testing of materials :-

(a) The contractor shall be responsible for various tests to be carried out in the site laboratory which will be set up by the contractor for testing of material at his own cost and arrangement and for that, they shall employ a competent technical representative as approved by Accepting officer. All such tests shall be carried out in presence of rap of executing authority. The cost of labour & materials for testing shall be borne by contractor. The following apparatus to be available in site labs for site testing.

a) CTM (Compressive testing machine)
b) Sieve (150micron to 40mm)
c) Rebound hammer
d) Varnier caliper
e) Screw gauge

f) Elongation pad
g) Measuring tape
h) Curing tank
i) Sprit level
j) Cutter
k) Digital weighing machine upto 10kg
l) Any other test apparatus reqd by accepting officer

Testing of materials:-

Cement - As per IS 1489 & 4031 (1993)
Aggregate – As per IS 2386 (2002)
Sand – As per IS 2386 (2002)
Structural concrete – As per IS 1199 (2004)
Water for constr – IS 456(2000)
Tiles - IS 1237 (2012)
TMT & Structural steel – IS 1786 (2008)
All Tests need to be done Command testing lab only and testing and transportation charges borne by vendor.

Electricals:- Internal electrification of the shelter shall be carried out all as per the approved make for the respective items in Annx-I and shall be ISI mark.

Air Conditioner: Supply installation of Hi wall split unit door/ outdoor wall mounted start rated with cooling and heating function complete with cordless remote control unit in built heating and cooling arraignment anf digital invator twin rotary and voltage stabilizer of capisity 1.5 TR with all acesseries complete all as specified and as directed at site. (Qty 05 (for each UG TAC HQ)) (LG/ Samsung/ Daikin/ O-General/ Bluestar)

35 KVA Gen Set with complete accessories Scope of Work:- The work consists of supply of silent diesel engine driven generating set 35 KVA or nearest higher capacity 415 Volts, 3 Phase, as per IS-10001 1981 reaffirmed 2016 and alternator as per IS13364 Part 2 1992 reaffirmed 2003 or latest up to date. Liquid cooled engine consisting of Factory fitted of cold starting kit for pre heating of DG set before starting of DG set complete with manual control panel, along with all standard accessories enclosed in acoustic enclosure to reduce noise pollution and including fitted of retrofit emission control device as per central pollution control board noise pollution norms. 49 BHP at 1500 RPM Three phase 415 Volt AC 50 Hz 0.8 PF, 28 KW, 49 Amps, 24 Volt electric start liquid cooled diesel engine coupled with 35 KVA alternator coupled on a common base frame. Construction of PCC platform for installation of Gen set with PCC 1:2:4 type B-2 with 40 mm graded stone aggregate of suitable size as per drawing prescribed by manufacturer will be carried out by the vender before installation of DG set. Details of technical specification are as under.

Note:-Initial testing shall be done by the supplier at consignee for 12 Hrs and cost of fuel, testing equipment etc. for testing and construction of PCC platform for DG set will be deemed to be included in quoted rates of DG set.

1. Design criteria

(a) Engine:-

(i)	Cooling System	-	liquid cooled
(ii)	Electric starting system	-	24 Volts
(iii)	BHP	-	49
(iv)	KW	-	28
(v)	Amps	-	50.4 Amps
(vi)	Fuel Tank capacity	-	100 Ltrs
(vii)	Fuel	-	HSD
(viii)	Type of oil	-	15W40
(ix)	Nos of cylinder	-	3

(b) Alternator:-

(i)	Type	-	Brushless
(ii)	Voltage	-	415 Volts
(iii)	Rated speed	-	1500 rpm
(iv)	Rated current	-	49 Amps
(v)	Rated KVA	-	35 KVA
(vi)	No of phases	-	03
(vii)	Voltage regulation	-	± 1%
(viii)	Insulation system	-	Class ‘H’

(c) Accessories:-

(i)	Fuel tank inside canopy	-	01 No
(ii)	Control panel board inside canopy	-	01 No
(iii)	Fuel pipe fitted in canopy	-	01 Set
(iv)	Silencer fitted on canopy	-	01 No
(v)	Battery 12 Volts, 150 AH with copper lead and brass terminal(working temperature -30˚C to 50˚C,Battery type- LiFePO4)	-	02 Nos
(vi)	Engine starting/Shut off key push button	-	01 Set
(vii)	AVM pads with nuts and volts on mounting channels	-	01 Set
(viii)	Emergency stop button outside canopy	-	01 No

2. Standard set of tools:- Each generator will be provided with the following standard tools :-

(i)	Double ended spanner 1/4" x 5/16 BSF	-	01 No
(ii)	Double ended spanner 3/8" x 7/16 BSF	-	01 No
(iii)	Double ended spanner 14/17 mm BSF	-	01 No
(iv)	Double ended spanner 19/22 mm BSF	-	01 No
(v)	Plier combination	-	01 No
(vi)	Screw driver set	-	01 No

3. Running spares:- Each generator will be provided with one set of following Running Spares in addition to the Generator Set for maintenance in case of original built spares damaged/not working:-

(a)	Oil Filter with rubber ring	-	2 Nos
(b)	Fuel filter with rubber ring	-	2 Nos
(c)	Fuel injector pipe	-	1 Set
(d)	Over flow pipe	-	1 No
(e)	Benjo over flow pipe	-	2 Nos
(f)	Benjo Bolt	-	2 Nos
(g)	Fuel flexible pipe	-	1 No
(h)	Fan belt	-	2 Nos
(j)	Dynamo belt	-	1 No
(k)	Oil pressure pipe	-	1 No
(l)	Air Filter	-	1Set
(m)	Engine oil	-	20 Ltrs
(o)	Coolant	-	40 Ltr

4. Alternator:-

The alternator shall be exited and self regulated of 35 KVA 415 Volts, 3 phase 1500 RPM ,0.8 power factor and shall conform to IS:13364 Part 2: 1992 reaffirmed 2003). The alternators shall be of brush less type with VG-1, Grade of better grade or voltage regulation. The alternators shall be screen protected drip proof with min IP-21 degree of protection as per IS 46991/85(Reaffirmed 2004). The class of insulation of the alternator would be 'H'. The rated voltage of alternator will be 415 V of three Phases.

5. Diesel Engine (Naturally Aspirated)

(a) Diesel Engine shall be air cooled as specified , electric start developing required 49 BHP at 1500 RPM (as applicable) with Class A-2 Governing or better for alternator to deliver specified continuous 35 KVA output at 0.8 pf lag at NTP conditions (all rating shall be tested at 0.8 PF lag). The diesel engine should be capable of providing 10% overload for one hour for every 11 hours continuous running at full load.

(i) Naturally aspirated engine of rating up to and including 28 KW shall be ISI marked as per IS: 10001/1981 (reaffirmed 2016)

(ii) Naturally aspirated engine of ration up to and including 28 KW shall confirmed to IS: 10002/1981 with Amdt 1to 2)

(iii) The specific fuel consumption of engine shall be as per IS specification.

(iv) The Diesel Engine shall be complete with the following accessories

(a) Fuel tank with capacity for 12 hours continuous running at full load.

(b) Engine instrument panel consisting of starting switch with key, lube oil temperature and pressure gauges (water temperature gauge in case of water cooled engines), RPM indicator and hour meter.

(c) Safety controls to shut down the engine in the event of low lube oil pressure or high cylinder head temperature in case of air -cooled engines.

(d) Exhaust silencer of Residential type

(e) 24 V starting system complete with starter motor, charging alternator and cutout

(f) Sealed maintenance free dry battery Lithium Fero Phosphate (LiFePO4) of suitable rating with connecting cable and the batteries shall conform to relevant IS specification. The batteries of only following make shall be accepted: Exide, Amco, Amaron, Amar Raja, Tata Green. Provided to the consignees along with DG Sets, free of cost for each of DG Sets. 01 x Spare bty will be provided alongwith Gen Set.

(g) Factory fitted of cold starting kit for pre heating of DG set with all accessories, before starting of DG set.

6. DG SET MANUAL CONTROL PANEL:-

(a) The manual control panel shall be fabricated from steel of 1.5 mm thickness minimum duly pre- treated and aesthetically finished. The control panel shall be totally enclosed , dust and vermin proof , floor mounted or wall mounted / skid mounted of integral type (un class specially specified as one of these option by DDOs with IP- 53 degree of protection and shall conform to IS/IEC 60947 (p-1)/2004). Firms shall get the item type tested as per revised standard.

(b) The control panel shall have the following instrument:-

- (i) Composite meter for digital display of
- (ii) Generator voltage
- (iii) Load current
- (iv) Power factor
- (v) Energy
- (vi) Frequency

(c) One MCCB of suitable rating for DG set.

(d) Push button – switch for ON and OFF operation.

(i) Pilot lamps, five Nos for three phase (One for each phase, one for load an set and one for charging on)

(ii) Battery charger complete with Voltage regulator , Voltmeter and ammeter should be provided for Trickle charging as well as Booster charging for charging the battery from mains. This will be in addition to the battery charging alternator fitted on the engine.

(iii) All the components in the control panel shall be properly mounted, duly wired and labeled. Suitable terminals are to be provided for panel incoming and outgoing connections. The instrument / components shall be of repute make.

Supplier shall furnish complete & satisfactory TTC for engine alternators complete with enclosure to be used by them for each rating of DG set clearly indicating make, model and ratings of DG sets tested at the time of registration and pre- dispatch inspection.

The TTC of three phase alternators shall cover unbalance load as per cl 2 of IS : 13364 part 2)/1992 as applicable. Type test certificate 4 issued by recognized Government Lab will be mandatory. The testing of diesel generating sets, for all ratings, shall be done at 0.8 PF lag.

Testing shall be done at continuous power output for each rating. Necessary gauge/ meters shall be fitted to indicated and 01 spare set to be provided:-

(a) The quantity of fuel left in fuel, and

(b) Hours of DG set operation.

DG set shall be provided with integrated acoustic enclosure which shall conform to latest norms of Central Pollution Control Board (CPCB) The acoustic enclosure offered shall conform to the drawing type

approved by Govt lab , for conformity to noise norms. This aspect shall also be verified at the time of inspection. DG sets shall meet the requirement of Environmental (Protection) Rules 1986 as laid down by Min of environment & Forests read with GSR 371 (E) dated 17 May 2002. GSR 520 (E) dated 01 July 2003, No 448 (E) dated 12 Jul 2004. , GSR 771 (E) dated 11 Dec 2015 & GSR 232 (E) dt 31 Mar 2014 Gazette notification No 167 dt 31 Mar 2014 and Gazette Notification No- 578 dt 11 Nov 2014 in respect of noise and emission norms . The latest amendment to above GSRs shall be applicable as and when amended by Ministry of Environment and Forest. DG sets shall also meet all other statutor requirement as notified by Govt from time to time.

DG supplier shall furnish following documents issued by a Govt authorized agency at the time of registration and pre - dispatch inspection.

(a) Type approval certificates (TAC) for emission norms for Each mode/family of engine.
(b) TAC from for noise level norms each model of DG set
(c) COP for Each model of DG set and engine used in DG set

Scope of supply shall include supply and commissioning of the complete DG set at the consignee's end. Vendor/supplier shall furnish list of authorized service centers through the country with complete address phone No, Fax & email etc. DG set manufactures' shall provide a list of inventories being supplied with the DG set , to enable the consignees to verify them, at the time of delivery. The inventory list shall be attached along with the inspection notices. Electronic governor shall also be acceptable in place of mechanical governor.

7. Emergency Shutdown:- Provn of Emergency shutdown switch should be incorporating to cater for any exigencies.

8. Fuel Tan:-. Removable sheet metal fuel tank with capacity for fuel load non-stop 12 Hrs running complete with inlet spout with strainer, fuel level indicator, Fuel out let approx 25 mm above the bottom, Engine over flow inlet at top capacity 100 Ltrs in the base of the canopy.

9. Literature and Operating Manuals:- One set of following literature shall be provided for each Generator set in a CD containing of foll0owing :-

Working repair manual	- One
Spares part catalogue	- One
List of special maintenance tools	- One
Operators instructions, users hand book/maint manual	- One
Training manual/training Charts	- One
Dealer Network book/leaflet	- One
Log Book	- One
CD containing Literature	- One

10. Noise limit after installing Acoustic enclosure:-

The maximum sound pressure level for the generator set shall be 75 db (A) at 1 meter from the enclosure. The specification of the acoustic enclosure is given in the succeeding paragraphs. The “Techno Acoustic” Noise Control System, in total is so designed as to achieve sound level outside the DG set room at a distance of 1 meter away from external wall at db or less.

11. Acoustic Enclosure:-

Acoustic enclosure system of Generator should be made out of cold rolled sheet steel/ hot rolled MS channels or CRC cold formed prefabricated steel sections, weather proof, suitable for outdoor installation complete with suitable fasteners. The acoustic enclosure must be ready to assemble condition complete with acoustically treated walls, roof panels and doors. The walls and roof panels comprise of double walled CRC plain and perforated press bent sheets outside and inside respectively. The mineral wool mattresses are sandwiched through suitable framing and stiffener channels. The panels are mounted on the structure clamps and fasteners for proper sealing of panels and bulb type neoprene sealing gaskets are to be provided. Necessary doors and openings as per site requirement to be provided.

12. Sound Reduction Doors (SRD):-

SRDs are to be fabricated out of 2 mm thick CRC sheets and the construction in same as wall and roof panels. The door frames are fabricated from 2.5 mm thick CRC cold-formed section. Suitable pad plates are provided for mounting handle for proper sealing. Door handle have both side operations with locking arrangement from outside. Bulb type neoprene gasket is to be provided similar to the wall panels.

13. Ventilation and Air Circulation System:-

Air ventilation and circulation system is most important for efficient performance of equipment inside the acoustic enclosure/room. The system should be suitably designed to provide opening for air intake and exhaust including radiator exhaust. Depending on the air requirement, suitable fan/blowers to be provided and all the openings, mounting arrangements for fan/blower complete with louvers/silencers are to be designed and supplied. For radiator, exhaust suitable duct with silencer to be provided.

14. Cable :-

Armored PVC sheathed Aluminum cable and its necessary laying and termination shall be done by firm. The current rating of the cables shall be as per table attached. The length of the cable shall be within 100 mtrs for DG sets with manual control panel. LT UG Cable 25 sqmm 3.5 core, 100 RM, Changeover switch 63 Amp TPN (Qty-02 Nos) ISI mark. Main switch 63 Amp TPN (Qty-02 Nos) with ISI mark.

Note :- Rates of items are included in the cost of Genr Set.

15. Earthing:-

Building suitable earthing station and necessary connections shall be done by firm. In case of 3 Phase DG sets, the total number of earthing pits/stations shall be 4 i.e. 2 for neutral and 2 for body-earthing. In case of single phase DG sets, the total number of earthing station shall be 2 and it shall be used for body-earthing. The consignee should choose installation site in such a way that the earthing station can be made within 20 meters of the DG set. Earthing station shall be typically built as per prevalent standard practices. Earthing of Generator will be provided using GI strip 32 x 6mm as earthing lead to GI earth plate of size 600mm x 600mm x 6mm thick, PCC pit, CI cover of size 450mmx450mmm, GI funnel, GI tube 20mm dia 1500mm long, termination point, 25 kg wood charcoal granules size not less than 10 mm (in HDPE bags), 25 kg edible rock salt granules (in HDPE bags) complete all as specified –Qty -04 (Four) Sets per each Generator.

16. Canop:-

. DG set shall be protected by canopy on top of DG set factory fabricated GI angle iron of 40mmx40mmx5mm and GI sheet of 3 mm thick with extra projection shall be provided and slope on both side length wise of DG set .

17. Warranty for 35 KVA Gen Set:-

The supplier will give free warranty for engine, alternator, self, batteries, control panel and remaining accessories for a period of minimum 24 months from the date of supply , for generator which do not require commissioning or for a period of minimum 18 month from the date of commissioning and successful testing , for generator which required commissioning, whichever is later .

BILL OF ITEMS

Estimatation for Construction of Force Protection Bunker (Part A)			
S.No	**Item of work**	**Unit**	**Qty**
1	Trench excavation in hard soil leads upto 50mtr and lift upto 1.5mtrs.		
	Top Side : 21x11 = 231		
	Bottom Side: 18x8 = 144		
	231+144/2 x3.5 = 656.25 cum		656.25
	Footing Excavation : = 14 cum		14.00
	Total		670.25
2	Providing And Laying 100mm thick Lean Concrete		
	Footing: = 6.88	cum	5.89
	Col: 5.09	cum	5.09
	Plinth protection: 2(15.90+5.90)0.10m = 4.36 cum	Cum	4.36
	Total	cum	15.34
3	Cast insitu reinforced cement conc. with nominal mix M-25 grade with 20mm nominal size agg.		
	Footing: = 6.88 cum	cum	6.88
	Col.: = 5.09 cum	cum	5.09
	Beam : 5(6.20x0.30x0.30) = 2.79 cum	Cum	2.79
	Slab: 19x9x0.30 = 51.3 cum	cum	51.30
	Stair: 28 cum	cum	28.00
	Total	cum	94.06
4	Providing mild steel reinforcement.		
	Vide item No.3 @150kgs/ cum	Kg	14109.00
5	Providing and Laying Auticlaved Aerated Cement Block masonry with 150mm/230mm/300mm thick AAC Blocks in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Enginner-In-Charge. 2 x 4.3 x 3.048 x 0.46 = 12.06 2 x 12 x 3.048 x 0.46 = 33.65 Total = 45.71 sqm	cum	45.71
6	Centering and shuttering including strutting propping etc and removal of form work.		
	Footing: 20.07		20.07
	Col.: 55.76		55.76
	Beam : 5(0.30x0.30) = 0.45		0.45
	Slab : 51.3 sqm		14.00
	Stair: 21.37		21.37
	Total	Sqm	111.65
7	12mm plaster in single coat.		
	Walls 2x2(16x3.048+6.3x3.048) = 272	Sqm	272.00
	Ceiling: 19x9 = 171 sqm	sqm	171.00
	Total	sqm	443.00
8	50mm thick cement concrete flooring.		
	15m x 5.3m = 79.5 sqm	Sqm	79.50
9	Providing soft earth cushion over slab	Cum	173.00
10	Provision for ventilation	LS	

11	Provision for Washrooms including piping fittings and disposal of sevage and sewarage, 2 Lakh/ point. For 1 points +	No	1.00
12	Provision for septic tank and soakage pit with all connections, @3 Lakh	LS	
13	Construction of cement concrete drain.	cum	2.00
14	Provision for Canopy (MS Pipe, MS angle , PPGI Sheet)	LS	
15	Provision for Puff Panels @ 2500/sqm	sqm	124.00
16	Provision for Plinth protection	cum	3.40
17	Provision for plaster of paris on walls and ceilings,		
	Walls 2x2(16x3.048+6.3x3.048) = 272	Sqm	272.00
	Ceiling: 15 x 5.3	sqm	79.50
	Total	sqm	351.50
18	Provision for waterproofing sheets over slab, 16x6.3	LS	101.00
19	Provision of water supply and overhead tank including insulations	LS	1.00
20	Steel Doors including accessories	No	2.00
21	Provision for solar inverter and water hearter	No	1.00
22	Provision of Breast wall:		
	Providing and Laying plain cement concrete M15 with 30% plum for construction of Breast wall around the trench with weep holes at certain intervals as per design and draiwng	cum	118.00
	(0.6x1x3.5)56 =117.6 cum		
23	Installation of oil Bukharies in LIV Bunker @ 2 no for each bunker i.e. for 20 ns of bunkers=40	No	40

Estimatation for construction of UG Tac HQ (Part B)

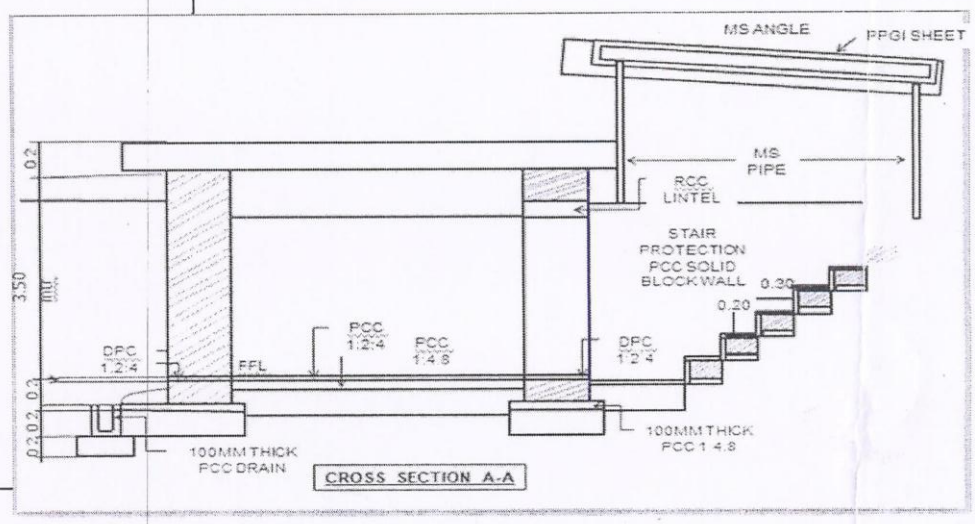
S.No	Item of work	Unit	Qty
1	Trench excavation in hard soil leads upto 50mtr and lift upto 1.5mtrs.		
	Top Side : 27x11 = 297		297.00
	Bottom Side: 22x8 = 176		176.00
	297+176/2 x3.5 = 827.75 cum		827.75
	Column Footings Excavation : = 30 cum		30.00
	Total		857.75
2	Providing And Laying 100mm thick Lean Concrete		
	Footing: 2(20x1.45+5.30x1.45)x0.10m = 7.337	cum	7.34
	Flooring: 20x5x0.10 = 10 cum	cum	10.00
	Plinth protection: 2(20.90+5.90)0.10m = 5.36 cum	cum	5.36
	Total	cum	22.70
3	Cast insitu reinforced cement conc. with nominal mix M-25 grade with 20mm nominal size agg.		
	Footing: 2 (20x1.45+5x1.45)x0.45 = 32.625 cum	cum	32.63
	RCC Walls: 2(20x3.5+5x3.5)x0.45 = 78.75 cum	cum	78.75
	Beam : 4 (6.20x0.30x0.30) = 2.232 cum	Cum	2.23
	Slab: 24x9x0.30 = 64.8 cum	cum	64.80
	Stair: 28 cum	cum	28.00
	Total	cum	206.41
4	Providing mild steel reinforcement.		
	Vide item No.3 @150kgs/ cum	Kg	30961.05
5	Centering and shuttering including strutting propping etc and removal of form work.		
	Footing: 46 sqm		46.00
	RCC Walls: 354.2 sqm		354.20
	Beam : 4(0.30x0.30) = 0.36		0.36
	Slab : 65 sqm		65.00
	Stair: 21.37		21.37
	Total	Sqm	486.93
6	12mm plaster in single coat.		
	Walls: 2x2x(20x3.048+7x3.048) = 330	Sqm	330.00
	Ceiling : 24 x 9 = 216	Sqm	216.00
	Total	Sqm	546.00
7	50mm thick cement concrete flooring.		
	20m x 5 m = 100 sqm	Sqm	100.00
8	Providing soft earth cushion over slab, 22x7x1.2m	Cum	185.00
9	Provision for ventilation	LS	
10	Provision for Washrooms including piping, fittings and disposal of sevage and sewarage, 2 Lakh/ point. For 5 points	No	5.00
11	Provision for septic tank and soak pit with all connections, @ 3 Lakh	LS	1.00
12	Construction of cement concrete drain.	cum	4.00
13	Provision for Canopy (MS Pipe, MS angle , PPGI Sheet)	LS	

14	Provision for Puff Panels @ 2500/sqm, 50x 3.5m	sqm	175.00
15	Provision for Plinth protection ,2(22+5) x 0.10 x 1m	cum	5.40
16	Provision for partition and doors	sqm	136.50
17	Provision for plaster of paris on walls and ceilings,		
	Walls: 2x2x(20x3.048+7x3.048) = 330	Sqm	330.00
	Ceiling : 22 x 7 = 154	Sqm	154.00
	Total	Sqm	484.00
18	Provision for waterproofing sheets over slab, 22x7	LS	154.00
19	Provision for 35 KVA Generator		1.00
20	Provision of water supply and overhead tank including insulations		1.00
21	Doors including accessories	No	12.00
22	Steel Doors including accessories	No	2.00
23	Provision for solar inverter and water hearter	No	1.00
24	Provision of Breast wall:		
25	providing and laying plain cement concrete M15 with 30% plum for construction of Breast wall around the trench with weep holes at certain intervals as per design and draiwng		
	(0.6x1x3.5)66 =138.6cum	cum	139.00
26	Installation of AC with both heating and cooling function (LG/ Samsung/ Dakin/ O General/ Bluestar) @ 05 per UG TAC HQ)i.e. for 5 UG TAC HQ)	No	25

TENDER DRAWINGS

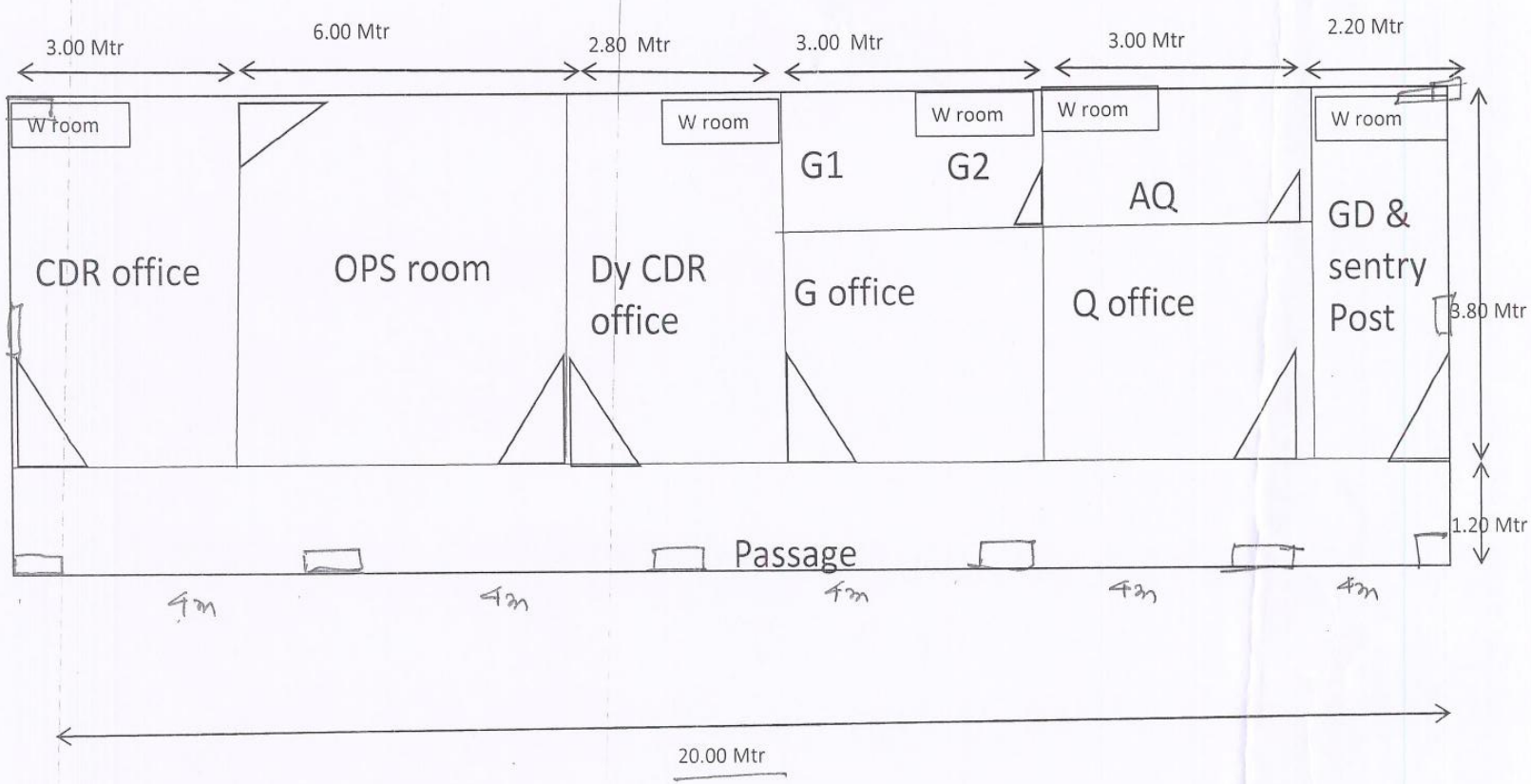
Line sketch of Force protection bunker of size 15.00 x 5.00 x 3.5 mtr

Size 15.00 x 5.00 x 3.5 mtr



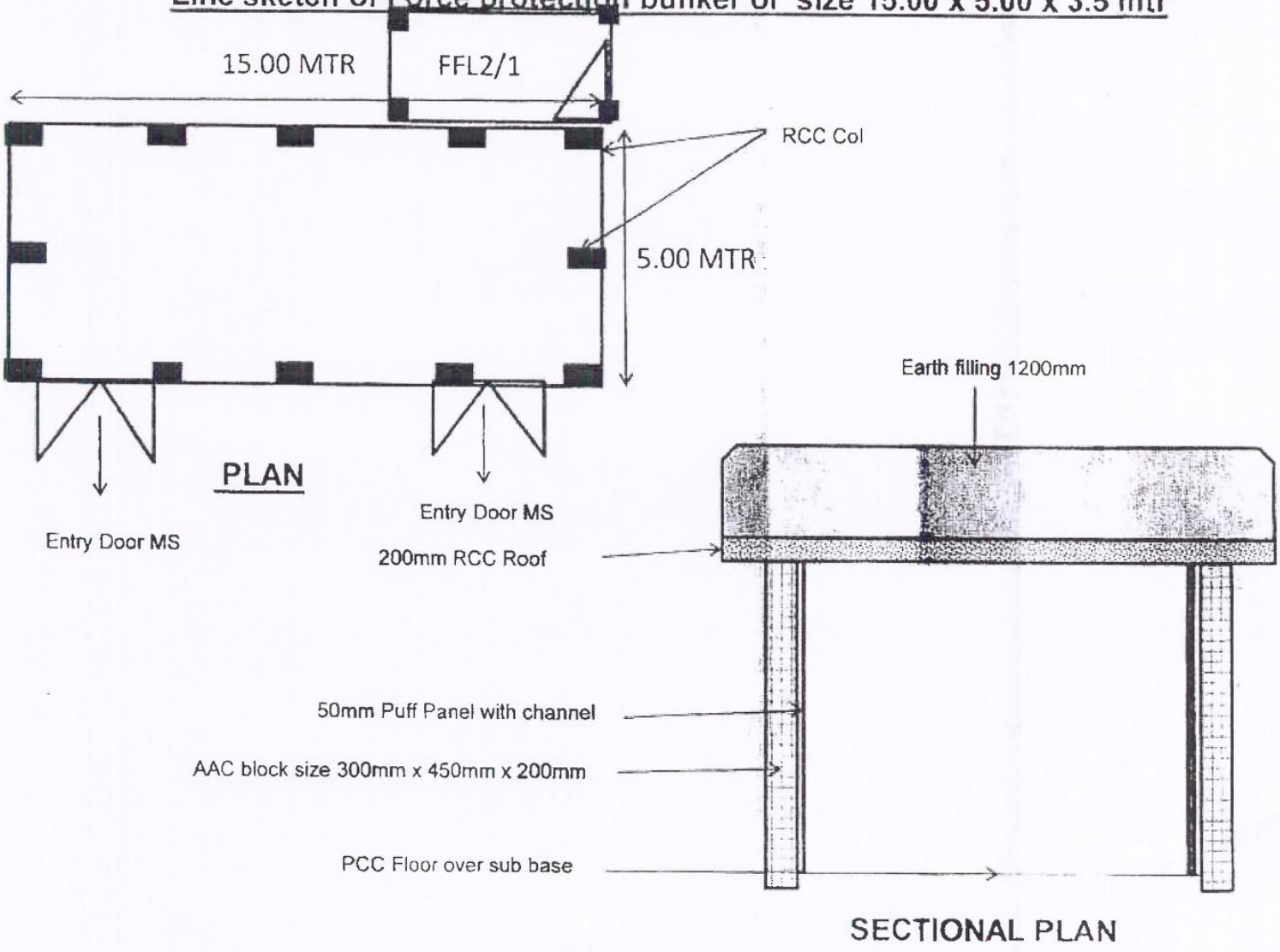
Reqmt:-

(a) Shelter should accommodate ORs during emergency.
(b) Toilet facility should be provided.
(c) Structure should be underground.
(d) Structure capable to withstand Art shelling,RL fir etc
(e) Internal walls to be provided insulation to maintain normal temp.
(f) Structure shall be provide earth filling of 1200mm at roof.
(g) Natural light/Vent arrangements reqd as structure is UG.
(h) Sewage Disposal/Drainage/Water supply arrangements reqd.
(i) Suitable staircase to be provided.


3.00 Mtr
6.00 Mtr
2.80 Mtr
3..00 Mtr
3.00 Mtr
2.20 Mtr
W room
W room
W room
W room
W room
G1
G2
AQ
GD &
sentry
Post
CDR office
OPS room
Dy CDR
office
G office
Q office
3.80 Mtr
1.20 Mtr
Passage
4m
4m
4m
4m
4m
20.00 Mtr

UG Tac HQ x 4 =

Line sketch of Force protection bunker of size 15.00 x 5.00 x 3.5 mtr



The End