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AN ISO 9001:2015 CERTIFIED DEPARTMENT

Proposed Air-conditioning of the SO Bikramganj (BO Dehri- on- Sone) & SO Dighwara (BO Chapra -1) under DO-2 Patna – Invitation of E-Tender on Percentage Rate basis for SITC Air Conditioners including Electrical Installation work

BID – II

Technical BID & Schedule of Quantity

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CONTENTS

CONDITIONS OF CONTRACT

1. INTERPRETATIONS:

1.1 In construing these Conditions, the Specifications, the Priced Schedule of Quantities, Tender and Agreement, the following words shall have the meanings herein assigned to them except where the subject or context otherwise requires:

1.2 "Employer" shall mean THE LIFE INSURANCE CORPORATION OF INDIA and his (their) heirs, legal representatives, assignees and successors.

1.3 "Chief Engineer" shall mean the person occupying the post of head of the Zonal Engineering Department of the Corporation.

1.4 "Corporation's Engineers" shall mean such Deputy Chief Engineers, Superintending Engineers and/or Executive Engineers of the Corporation, who shall from time to time be appointed by the Chief Engineer for supervising the work carried out by the Contractor or for any purpose in connection therewith:

1.5 The term "Site Engineer" shall mean the person appointed and paid by the Employer, acting under the order of the Corporation's Engineer to superintendent the work.

1.6 The Contractor shall mean the individual, firm or company whether incorporated or not, who is awarded the contract & shall include the legal representative of such individual or the persons composing such firm or company or the successors of such individual, firm or company & the permitted assignees of such individual, firm or company.

1.7 The "Site" shall mean the lands/buildings and/or other places on, in, into or through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

1.8 "This Contract" shall mean the Articles of Agreement, these Conditions, the General Instructions to Contractor, the General Preambles to Schedule of Quantities, Special Conditions, the priced Schedule of Quantities, the Specifications, the Appendices, the Drawings and other related correspondence.

1.9 "Act of Insolvency" shall mean any act of insolvency as defined by the Presidency Towns Insolvency Act, or the Provincial Insolvency Act or any amending Statute.

1.10 "Notice in Writing" or written notice shall mean a notice in written, typed or printed characters, sent (unless delivered personally or otherwise proved to have been received) by registered post

to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

1.11 Words importing persons include Firms and Corporations, words importing the singular only also include the plural and vice versa where the context so requires.

1.12 The titles of the Clauses shall not affect or alter the meaning of Clauses and are solely for the purpose of facilitating reference.

1.13 The following abbreviations shall be followed for the designations of various LIC Officers:

DESIGNATIONS	**ABBREVIATIONS**
Executive Director (Engineering)	E.D.(E)
Zonal Manager	Z.M.
Chief Engineer	C.E.
Chief Architect	C.A.
Deputy Chief Architect	D.C.A.
Deputy Chief Engineer	Dy.C.E.
Superintending Engineer	S.E.
Senior Architect	S.A.
Executive Engineer	E.E.
Deputy Senior Architect	D.S.A.
Asstt. Secretary	A.S.

1.14 Wherever the words “approved”, “directed”, “as required”, “selected” or words of like effect are used, it is to be understood that the approval/direction, requirement or selection of the Corporation’s Engineer are intended unless otherwise specified.

1.15 The words “as described” shall mean the description in the Special Conditions, Specifications, General Instructions, Drawings etc. of this tender.

1.16 The words “allow” shall mean that the Contractor shall include in his rates for the particular matter referred to.

1.17 “Day Work” shall mean items of labour and/or materials which in the opinion of the Corporation’s Engineer are not capable of being evaluated by the accepted method of measurement and analysis.

2. SCOPE OF CONTRACT:

2.1 The Contractor shall carry out and complete the works in every respect in accordance with this Contract and in accordance with the directions and to the satisfaction of the Corporation’s

Engineer. The Corporation's Engineer may issue further drawings and/or written instructions, details, directions and explanation in regard to:

a. The variation or modification of the Design, quality of works or the addition or omission or substitution of any work;

b. Any discrepancy in the Drawings or between the Schedule of Quantities and/or Drawings and/or Specifications;

c. The removal from the site of any materials brought thereon by the Contractor and the substitution of any other material thereof;

d. The removal and/or re-execution of any work executed by the Contractor;

e. The dismissal from the work of any persons employed thereupon;

f. The opening up for inspection of any work covered thereupon;

g. The amending and making good of any defects under relevant Clause giving details of defects after completion.

2.2 The Contractor shall forthwith comply with and duly execute all works comprised in such Instructions subject to the provisions of relevant specific conditions of the Contract. In the event of any dispute or difference of opinion the contractor shall refer the matter within 7 (seven) days of the issue of such instruction to the Chief Engineer whose decision shall be final & binding.

3. *DISCREPANCIES:*

3.1 If there are varying or conflicting provisions made in any one document forming part of Contract, the Chief Engineer shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

3.2 The several documents forming the Contract are to be taken as mutually explanatory of one another, and the order of precedence shall be as follows;

a) Special conditions
b) General preambles to schedule of quantities
c) General instructions
d) Conditions of contract

3.3 In case of discrepancies between the Schedule of Quantities, the specifications and/or drawings the following order of precedence shall be observed

(a) Description in Schedule of Quantities
(b) Specifications of relevant Trade
(c) Drawings; detailed drawings shall be followed in preference to small scale drawings and figured dimension in preference to scale.
(d) Indian Standard Specifications of `BIS'

4. DRAWINGS AND SCHEDULE OF QUANTITIES:

4.1 Two complete sets of the Drawings and Specifications and Schedule of Quantities shall be furnished by the employer to the contractor. Two copies of the additional Drawings, if any, shall be furnished within such time as the Chief Engineer may consider reasonable which may be necessary for execution of any part of the work. Such copies shall be kept on the work site and the CE and his representatives shall at all reasonable times have access to the same and they shall be returned to the EE by the Contractor on completion of the contract.

This Contract and the signed Drawings, Specifications and Schedule of Quantities shall remain in the custody of the Employer.

5. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY FOR EXECUTION OF WORK:

5.1 Contractor shall provide everything necessary for the proper execution of the work according to the intent & meaning of the Drawings, Priced Schedule of Quantities and Specifications taken together, whether the same may or may not be explicitly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy therein he shall immediately and in writing refer the same to the CE whose decision shall be final and binding on the Contractor.

5.2 The Contractor shall supply, fix and maintain at his cost during the execution of any work all the necessary Centering, Scaffolding, Staging, Planking, Timbering, Strutting, Shoring, Pumping, Fencing, Boarding, Watching and Lighting by night as well as by day, required not only for the proper execution and protection of the said work but also for the protection of the Public and the safety of any adjacent Roads, Streets, Cellars, Vaults, Ovens, Pavements, Walls, Houses, Buildings and all other erections, matters or things and the Contractors shall take down and remove any or all such Centering, Scaffolding, Staging, Planking, Timbering, Strutting, Shoring, etc., as occasion shall require or when ordered to do so, and shall fully reinstate and make good all matters and things disturbed during the execution of the work to the satisfaction of the Corporation's Engineer.

6. AUTHORITIES NOTICES AND PATENTS:

6.1 The Contractors shall conform to the provisions of any Acts of the Legislature relating to the work and to the Regulations and Bye-Laws of any Authority and or any Water, Lighting and other Companies and/or Authorities with whose system the structure is proposed to be connected and shall before making any variations from the Drawings or Specifications that may be necessitated by so conforming give to the CE written notice specifying the variations proposed to be made and the reasons for making them and apply for instructions thereon. In case the Contractor shall not

within 7 (seven) days receive such instructions, he shall proceed with the work conforming with the Provisions, Regulations or Bye-Laws in question.

6.2 In particular, the Contractors shall be responsible to Register themselves under the Contract Labour (Regulation & Abolition) Act 1970 and Rules there under and any amendment thereto; they must comply with and carry out all the provisions and obligations under the said Act and Rules and furnish all information to Employer as may be required by it and shall indemnify the Employer against any penalties/claims arising from any default on their part.

6.3 The Contractor shall arrange to give all notices required by the said Acts, Regulations or Bye-Laws to be given to any Authority and to pay to such Authority or to any Public Office all fee that may be properly chargeable in respect of the work and lodge the receipts with the Employer.

6.4 The Contractors shall indemnify the Employer against all claims in respect of patent, rights, and shall defend all actions arising from such claims unless he has informed the Chief Engineer before any such infringement and received his permission to proceed and shall himself pay all royalties, licence fees, damages, costs and charges of all and every sort that may be legally incurred in respect thereof.

6.5 The Contractor should observe that his work shall not cause any nuisance to the Public in general and to the neighbouring occupants in particular.

6.6 Should the Contractor desire to work on Sundays, Holidays and during night hours, permission in writing from the Corporation's Engineer must be obtained in time. It shall be the responsibility of the Contractor to obtain permission from Civil Authorities, if necessary.

7. SETTING OUT WORK:

7.1 The Contractor shall set out the work and shall be responsible for the true and perfect setting out of the same and for the corrections of the positions, levels, dimensions and alignment of all parts thereof. If at any time any error shall appear during the progress of any part of the work, the Contractor shall at his own cost rectify such error, if called upon, to the satisfaction of the Corporation's Engineer. The Contractor must not commence work until the outlines of the building and Centre line layout have been pegged out and approved by the Corporation's Engineer.

8. CONTRACTOR IMMEDIATELY TO REMOVE OFFENSIVE MATTER:

8.1 All soil, filth or other matter of an offensive nature taken out of any trench, sewer, drain, cesspool or other place shall not be deposited on the surface, but shall be at once carted away by the Contractor to some pit or place provided by him.

9. MATERIALS AND SAMPLES:

9.1 All the materials stores and equipment required for the full performance of the Contract must be provided through normal trade channels and must include applicable import duties and all applicable taxes and other charges, if any. They shall be of approved quality and the best of their kind available and the Contractor must be entirely responsible for the proper and efficient carrying out of the work. The Contractor shall order all materials required for the execution of the work from local as well as from outside sources if situation warrants so as early as necessary to the satisfaction of the Corporation's Engineer and to ensure that such materials are on site well ahead of requirement for use in the work. Non – availability of materials in local market will not be an issue behind slow progress of work.

9.2 Before ordering such materials, the Contractor shall get samples of the materials approved well in time. Preference shall be given to ISI marked products and approved brands of requisite quality as mentioned in the tender. For materials, which are neither approved brands nor ISI marked, the same shall be got tested from approved laboratories at the Contractor's cost before approval. Approved brand and ISI marked product will also be tested if desired by the CE and if the test results are satisfactory, the cost of testing shall be borne by the Employer otherwise by the Contractor. No claim will be allowed for delay to the progress of work caused by test. If called upon by the Executive Engineer the Contractor shall produce proof for having arranged for the supply of materials well in time.

9.3 The Contractor shall furnish well in time before work commences at his own cost, any samples of workmanship that may be called for by the Corporation's Engineer for his approval and any further samples in case of rejection until such samples are approved. Such samples when approved shall be the minimum standard for the work to which they apply. In case of items like suspended ceiling, partitions, etc. typical sample panels or proto-types shall be erected in position for approval before undertaking work. Rates quoted shall cover for such preliminary work.

10. ACCESS:

10.1 Any of the Corporation's Engineers or any persons authorized by any one of them shall at all reasonable time have free access to the work and/or the workshops, factories or other places where materials are being prepared or constructed for the Contract and also to any place where the materials are lying or from which they are being obtained and the Contractor shall give every facility to all of them necessary for inspection and examination and test of the materials and

workmanship. Except the representatives of the Public Authorities, no person shall be allowed on the work at any time without the written permission of the Corporation's Engineer.

If any work is to be done at a place other than the site of the work, the Contractor shall obtain the written permission of the Corporation's Engineer for doing so.

12. DISMISSAL OF WORKMEN:

12.1 The Contractor shall, on the instruction of the Corporation's Engineer, immediately dismiss from the work any person employed thereon, who may, in the opinion of the Corporation's Engineer, be unsuitable or incompetent or who may misconduct himself and such person shall not be again employed or allowed on the work without the permission of the Corporation's Engineer.

13. DATES OF COMMENCEMENT AND COMPLETION:

13.1 The "Date of Commencement" shall be as stated in the Work Order and the Contractor shall thereupon and forthwith begin the work and shall regularly proceed with and complete the same on or before the "Date of Completion" stated in the Work Order, subject to the provisions for extension of time hereinafter contained.

14. ASSIGNMENT:

14.1 The whole of the work included in the Contract shall be executed by the Contractor and the Contractor shall not directly or indirectly transfer, assign or underlet the Contract or any part, share of interest therein nor shall he take a new partner without the written consent of the CE and no subletting shall relieve the Contractor from the full and entire responsibility of the Contract or from the active superintendence of the work during its progress.

15. DEVIATION, VARIATION, EXTRA/DEVIATED ITEMS AND PRICING:

15.1 The Contractor should note that unless otherwise stated, the tender is strictly on Item Rate basis and his attention is drawn to the fact that rates for each and every item should be correct, workable and self supporting. The quantities in the Schedule of Quantities approximately indicate the total extent of work and no variation i.e. additions, omissions or subtractions shall vitiate the Contract. No liability shall attach to the Employer for any error therein or variation there from.

15.2 The contractor may when authorized and shall when directed, in writing by the CE or the Corporation's Engineers, whom the CE may for that purpose appoint, add to, omit from, make alterations in, substitutions for, or vary the works shown upon the Drawings or described in

Specifications or included in the priced Schedule of Quantities but the Contractor shall make no additions, omissions, alterations, substitutions or variations without such authorization or direction. A verbal authority or direction by the CE, if confirmed by the contractor in writing within 7 (seven) days, be deemed to have been given in writing.

15.3 The rates of such altered, additional or substituted works shall be determined in accordance with the following.

a. The net rates or prices in the original tender shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced therein.

b. The net price of the items in the original tender shall determine the value of the items omitted. However, if omissions vary the conditions under which any remaining items of the work are carried out or if the amount of any omission relative to the amount of the whole of the Contract works or to any part thereof shall be such that in the opinion of the Chief Engineer, the net rate or price contained in the Priced Schedule of Quantities or Tender or for any item of work involves loss or expenses beyond that reasonably contemplated by the Contractor and is by reason of such omission rendered unreasonable or inapplicable, the Chief Engineer shall fix another rate or price as in the circumstance he shall think reasonable and proper.

c. If the rate for any altered, additional, or substituted item of work is not specified in the schedule of quantities, the rate for that item shall be derived from the rate for the nearest similar item specified therein.

d. If the rate for altered, additional or substituted item of work cannot be determined in the manner specified above, then such items of work shall be priced on the basis of coefficients of labour and materials as given in the latest CPWD rate analysis handbook and rates for labour and materials wherever applicable shall be the market rate prevailing at the time of execution.

e. Where such co-efficient are not available in C.P.W.D. rate analysis, the actual Labour/Materials involved and recorded by the Executive Engineer in executing the items shall be considered.

f. Where extra work cannot be properly measured or valued, the Contractor shall be allowed “Day Work” prices at the net rates stated in the Tender or the Priced Schedule of Quantities or, if not so stated, then in accordance with the local “Day Work” rates and wages for the district, provided that in either case vouchers specifying the date and time (and if required by the EE the names of workmen employed) and materials incorporated be delivered for verification to the EE or his representative at or before the end of the week following that in which the work has been executed. The EE is not bound to

recognize the cost of materials furnished in vouchers; the CE at his discretion will fix the price of such materials based upon market value.

g. While fixing rates of extra items 15% (Fifteen percent only) shall be allowed over & above the basic rate of material (without GST), T & P, water charges and labour to cover all supervision, overheads, profits and all other applicable taxes/cess. GST on works contract will be paid separately.

h. Where the quantities of any item in the schedule exceeds by 100% in foundation and in plinth, and 50% in super-structure (above plinth), these extra quantities over 100% & 50% respectively will be treated as extra items of work and priced accordingly as above. [Items such as roads, pavements etc. shall be considered as below plinth]. The decision of CE for terming items below or above plinth is final & binding on the contractor.

i. For all extra items of work, the contractor should submit to the concerned Corporation's Engineer the necessary particulars along with his analysis and the rate he proposes to claim for consideration within a period of 4 (four) weeks from the time of cropping up of any authorized extra / deviated item. He shall also ensure that all the authorized claims are included in the final bill. If the contractor fails to submit his claim within the stipulated period or the period duly extended by the Corporation's Engineer, then the CE shall proceed to fix the rate for the item(s) and the same shall be final and binding on the contractor.

j. The Contractor shall note that Extra/Deviated items claim and/or any other claim whatsoever if submitted after submission of his Final Bill, will not be entertained and considered by the Employer. The Contractor shall not be allowed to make any Additions/ Alterations/ Revisions / Changes/ Modifications/ Variations in the final bill, after the final bill is submitted by him.

16. SUB-CONTRACTORS:

16.1 All specialist Merchants, Tradesmen and others, executing any work or supplying, fixing any goods for which provisional sums are included in the Schedule of Quantities and/or Specifications, who may be nominated or selected by the CE, who shall be the final authority are hereby declared to be Sub-Contractors and are herein referred to as nominated Sub-Contractors.

16.2 No nominated Sub-contractor shall be employed on or in connection with the work against whom the Contractors shall make reasonable objection or (save where the CE and the Contractor shall otherwise agree) who will not enter into a Contract providing:-

a. That the nominated Sub-Contractor shall indemnify the Contractor against the same obligation in respect of the Sub-Contractor as the Contractor is under, in respect of this Contract;

b. That the nominated Sub-Contractor shall indemnify the Contractor against claims in respect of any negligence by the Sub-Contractor or his servants or agents or any misuse by him or them of any scaffolding or other plant or the property of the Contractor or under any Workmen's Compensation Act in force.

17. THIRD PARTY LIABILITY, DAMAGE TO NEIGHBOURING PROPERTY, LOSS OF MATERIAL AND WORKMEN'S COMPENSATION:

17.1 The Contractor shall be responsible for all injury to persons, animals or things, and for all damage to structural and/or decorative part of property which may arise from the operations or neglect of himself or of any Sub-contractor or any of his Sub-Contractor's employees, whether such injury or damage arise from carelessness, accident or any other cause whatsoever in any way connected with the carrying out of his Contract. This Clause shall be held to include inter-alias, any damage to Building, whether immediately adjacent or otherwise and any damage to roads, streets, footpaths, bridges, or ways as well as all damage caused to the building, and the works forming the subject of this Contract by frost, rain, wind or other inclemency of the weather. The Contractor shall fully indemnify the Employer and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of all and any claim made in respect of injury or damage under any acts of Government or otherwise and also in respect of any award or compensation or damages consequent upon such claim.

17.2 The Contractor shall fully indemnify the employer against any loss, damage or deterioration for whatever reason, of all materials brought at site and especially material supplied by or paid for partly or wholly by the employer.

17.3 The Contractor shall reinstate all damage and loss of every sort mentioned in this Clause so as to deliver up the whole of the Contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of the third parties.

17.4 The Contractor shall fully indemnify the Employer against all claims which may be made against the Employer by any member of the Public or other third party in respect of anything which may arise in respect of the works or in consequence thereof.

17.5 The contractor shall at his own expense arrange to effect from the date of commencement & maintain till the date of virtual completion of contract, with any licensed general insurance company, a ***POLICY OF INSURANCE(Contractor's All Risk Policy)*** to cover all such risks detailed above viz. loss, damage & third party liability etc. The policy shall be of an amount as mentioned in Appendix to Conditions of contract and in the joint names of the employer & contractor and shall be deposited with the employer and renewed as required from time to time during the currency of the contract.

17.6 The Contractor shall also fully indemnify the Employer against all claims which may be made upon the Employer, whether under the ***WORKMEN'S COMPENSATION ACT*** or any other ***STATUTE*** in force during the currency of this Contract or at Common law in respect of any

Employee of the Contractor or any Sub-Contractor and shall at his own expense effect and maintain until the Virtual completion of the work, with "licensed General Insurance Company" a ***POLICY OF INSURANCE*** of adequate amount in the joint names of the Employer and the Contractor against such risks and deposit such policy or policies with the employer & renew the same as required from time to time during the currency of the Contract.

17.7 The Contractor shall be responsible for anything, which may be excluded from the Insurance Policies above referred to, and also for all other damage to any property arising out of or incidental to the negligence or defective carrying out of the Contract.

17.8 The amount of insurance to be taken for the above policies will be jointly decided between the contractor and the employer before issue of acceptance letter based on the tendered cost, nature of work, location of site, local hazards etc.

17.9 In default of the Contractor insuring as provided above, or having insured failing to renew the same as required the Employer on his behalf may so insure/renew and may deduct the premiums paid from any monies due or which may become due to the Contractor together with penalty as the CE deems appropriate.

17.10 The Contractor shall also fully indemnify the Employer in respect of any costs, charges or expenses arising out of any claim or proceedings at law and also in respect of any award of compensation of damages arising there from.

17.11 The Employer shall be at liberty and is hereby empowered to deduct fully the amount of any damages, compensation costs, charges and expenses arising or accruing any such claim of damage from any sum or sums due or to become due to the Contractor.

18. DELAY AND EXTENSION OF TIME:

18.1 If the works be delayed due to any of the following:

(a) by force majeure ,

(b) by reason of any exceptionally inclement weather,

(c) by reason of proceedings taken or threatened by, or disputes with, adjoining or neighbouring owners, or public authorities,

(d) by the work, or delays, of other Contractors or Tradesmen engaged by the Employer,

(e) by reason of any additional work or instruction ordered by the employer,

(f) by reason of Civil Commotion, local commotion of workmen or strike or lock-out affecting any of the building trades,

(g) in consequence of the Contractor not having received in due time necessary instructions from the CE for which he shall have specifically applied in writing,

(h) from other causes which the CE may certify as beyond the Control of the Contractor,

(i) by reason of non-payment of interim certificate at specified time,

Then upon the happening of any such event causing delay, the contractor shall immediately, give notice thereof in writing to the Corporation's Engineer, but shall nevertheless use constantly his best endeavours to make good this delay.

18.2 Request for extension of time shall be made by the contractor **at the earliest** of the event causing delay.

18.3 In case of strike or lockout the Contractor shall give written notice thereof to the CE as soon as possible but he shall nevertheless constantly use his endeavours to prevent delay and shall do all that may reasonably be required to the satisfaction of the CE to proceed with the work.

18.4 The CE shall make a fair and reasonable assessment of the delay and grant extension of time accordingly. Such extension shall be communicated to the contractor by the Corporation's Engineer immediately within **30 (Thirty) days of the date of receipt of request for extension**. Non-application by the contractor for extension shall however not be a bar for giving fair and reasonable extension which shall be as decided by the CE.

18.5 The decision of the CE as communicated by the Corporation's Engineer to the contractor on the extension of time shall be final & binding.

18.6 No claim in respect of compensation or otherwise, howsoever arising, as a result of extension granted under the above conditions shall be admissible.

19. COMPENSATION IN THE FORM OF PENALTY FOR DELAY OF WORK AND REWARDS FOR EARLY COMPLETION:

19.1 The Contractor shall submit a Time and Progress Chart (CPM/PERT/Quantified Bar Chart) within 10 (Ten) days of Letter of intent and get it approved by the Chief Engineer, LICI of the Zone. The Milestone Chart shall be prepared as produced below in direct relation to the time stated in the contract documents for completion of items of the works. It shall indicate the forecast (mile-stones) of the dates of commencement and completion of various items, trades, sections of the work and may be amended as necessary by agreement between the Chief Engineer, LICI and the Contractor within the limitations of time stipulated in the Contract documents and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work exceeds one month (save for special jobs for which a separate program has to be agreed upon) complete.

The physical progress report including photographs shall be submitted by the contractor on the prescribed format & the intervals (not exceeding one month) as decided by the Chief Engineer. The compensation for delay as per clause shall be leviable at intermediate stages also, in case the required progress is not achieved to meet the above time deadlines of the completion period and /or milestones of time and progress chart, provided always that the total amount of Compensation in the form of Penalty for delay to be paid under this condition shall not exceed 10% of the tendered value of work.".

Compensation in the form of Penalty for delay of work @ 1.5% of tendered value of work per month of delay to be computed on per day basis.

The amount of compensation in the form of Penalty shall be adjusted or set-off against any sum payable to the Contractor under this or any other contract with LIC. In case, the contractor does not achieve a particular milestone mentioned elsewhere in the tender document, or the re-scheduled milestone(s), the amount shown against that milestone shall be withheld and to be adjusted against the compensation levied at the final grant of Extension of Time if needed. 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."

20. FAILURE BY CONTRACTOR TO COMPLY WITH CE'S INSTRUCTIONS :

20.1 If the Contractor after receipt of written notice from the CE, requiring compliance with such further Drawings and/or his instructions, fails within 7 (seven) days to comply with the same the CE may employ and pay other persons to execute any such work whatsoever as may be necessary to give effect thereto and all additional costs incurred in connection therewith shall be deducted from any money due or to become due to the Contractor.

21. PAYMENT OF BILLS :

a. MEASUREMENT OF WORKS

21.1 The EE may, from time to time, intimate the contractor that he requires the work to be measured and the contractor shall forthwith attend or send a qualified representative to assist the EE or his representative in taking such measurements and calculations and to furnish all particulars or to give all assistance required by either of them. All items having a financial value shall be entered in the Measurement Book. All measurements and levels shall be taken jointly by the Contractor or his authorized representative and Site Engineer or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by both the parties in token of their acceptance. If any of the measurements recorded are objected by any one of the party, a note shall be made to that effect with reason, signed by both parties and referred to Corporation's Engineer whose decision in the matter shall be final and binding. Measurements can also be recorded through electronic medium where specifically approved by Chief Engineer.

21.2 Should the contractor not attend or neglect or omit to send such representative, then the measurements taken by the EE or representative shall be taken to be correct measurements of

the work. Wherever not specified in the "Schedule of Quantities or elsewhere" the mode of measurements shall be in accordance with the latest brochure issued by the Indian Standards Institutions (now renamed as Bureau of Indian Standards) on "Method of measurement of Building works".

21.3 The Contractor or his representative may, at the time of measurement, take such notes and measurements as he may require.

21.4 All authorized extra work. Omissions and all variations made without the Chief Engineer's knowledge, if subsequently sanctioned by him in writing, shall be included in such measurement.

21.5 If the contractor or his authorised representative does not record the measurements periodically for the completed works, then the site Engineer shall take measurements after giving notice in writing of at least 3 (three) days. Measurements recorded in the absence of Contractor shall be intimated with a copy of such measurements to the contractor. If the contractor fails to countersign or record objections within a week from the date of measurement, then such measurement recorded in absence by the Site Engineer shall be deemed to be accepted by and binding on the Contractor.

21.6 The Contractor shall, without any extra charge provide all assistance with every appliance, labour and other things necessary for taking measurements (either by him or by site Engineer) and recording levels including test checking of such measurements by any person authorised by the Employer.

21.7 All work shall be measured net as fixed in its place. All measurements of 'cutting' shall be held to include for the consequent wastage on the materials used.

21.8 Except where any general or detail description of the works expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items for which procedure is not covered in the specification, measurement shall be taken in accordance with the relevant Standard Method of measurement issued by BIS and if for any item no such standard is available then a mutually agreed method shall be followed.

21.9 Measurements of all hidden/concealed items of work including extra items if any, such as, work in foundations including excavations, plinth filling, masonry, concrete etc. steel in all R.C.C. work, pipe to be encased etc. shall be jointly recorded by the contractor and Site Engineer or his authorised representative before they are covered up. Immediately after the work is ready for measurements, Contractor will give specific notice to the Site Engineer for recording the measurements. If the Site Engineer or his authorised representative fails to record the measurements, the Contractor will refer the matter to the Corporation's Engineer for instructions, but in no case shall cover up work without the latter's permission.

22. PAYMENTS:

22.1 The contractor shall be paid by the Employer, from time to time, by installment under Interim Certificate to be issued by the EE to the Contractor on account of the work executed, when in the opinion of the EE, work to the approximate value named in the Appendix to the conditions of Contract as "Value of work for Interim certificate" (or less at the reasonable discretion of the Executive Engineer) has been executed in accordance with this contract, subject however to a retention of the percentage of such value mentioned in Appendix to the Conditions of Contract hereto as "Retention percentage on account of Security Deposit". The Interim Certificate shall be based upon interim Bills of Running Account Bills to be prepared by the Contractor and supported by the detailed measurements. The EE may include in the Interim Certificate such amount as he may consider proper on account of materials delivered upon the site by the contractor for use in the work, after satisfying price of materials on basis of vouchers/bills submitted by the contractor.

In case any material have been supplied by the Employer to the contractor in connection with the work, necessary recovery for the same shall be effected from the bills of the contractor by the CE at the issue rates of such materials as stipulated while calling for tenders and in other cases at a stock rate or market rates of such materials, whichever is higher. The contractor will, however, not be entitled to modify his rates for items of work requiring use of such materials and when the work has been virtually completed and the CE shall have certified in writing that it has been so completed on the basis of detailed measurements and after obtaining written endorsement by the CE that the CE/ Deputy Chief Engineer has made a final Scrutiny and that there are no disputed items, rates of quantities, the contractor shall be paid by the Employer in accordance with certificate to be issued by the CE the sum of money named in the Appendix as "Installment after Virtual Completion" and the contractor shall be entitled to the payment of the final bill in accordance with the final certificate to be issued in writing by the Deputy Chief Engineer with the approval of the CE with expiration of the period referred to as "Defects Liability Period", in the Appendix to Conditions of Contract hereto from the date of Virtual Completion or as soon after the expiration of such period as to work shall have been finally completed and all defects made good according to the true intent and meaning hereof, whichever shall last happen.

Provided always that the issue by the EE of any certificate during the progress of the works or at after their completion shall not relieve the contractor from his liability under Clause (2) in cases of fraud, dishonesty or fraudulent concealment relating to the work of materials or to nay matter dealt with in the certificate in case of all defects and insufficiencies in the work or materials which a reasonable examination would not have disclosed. No certificate of the Deputy Chief Engineer or Executive Engineer shall of itself be conclusive evidence that any work or materials to which it related are in accordance with the contract.

The Chief Engineer may make any correction in previous certificate which shall have been issued by the Executive Engineer/Superintending Engineer.

Payment upon the EE's certificate shall be made within the periods named in the Appendix "Period for honouring Interim Certificate" after such a certificate has been delivered to the Employer.

The CE shall have power to withhold any certificate if the work or any parts thereof are not being carried out to his satisfaction.

22.2 Provided always that the issue by the Corporation's Engineer of any Certificate during the progress of the works or after their completion shall not relieve the Contractor from his liability in cases of fraud, dishonesty or fraudulent concealment relating to the work or materials or any matter dealt with in the Certificate in case of all defects and insufficiencies in the work or materials which a reasonable examination would not have disclosed. No Certificate of the Corporation's Engineer shall of itself be conclusive evidence that any work or materials to which it related are in accordance with the Contract.

22.3 Payment upon the Corporation's Engineer's Certificate shall be made within the periods named in the Appendix "Period for honouring Interim Certificate" after such a Certificate has been delivered to the Employer;

22.4 The CE shall have power to withhold any Certificate if the work or any parts thereof are not being carried out to his satisfaction. However, if the final certificate is not issued within the period as mentioned under Clause No.22.5, 26 due to Audit para by CTE etc., the amount involved for such items of deficient work as decided by Chief Engineer would be with held. The same would be allowed as agreed upon by the CTE & the Chief Engineer and the final certificate would accordingly be issued and final bill passed. For such withheld amount, a simple interest @ 6% per annum shall be paid to the contractor along with the said payment. Such interest will be calculated from the last date (as mentioned in Appendix to Conditions of Contract) for honoring final certificate till the date of payment.

22.5 The measurements and valuation in respect of the Contract shall be completed within the "period of Final Measurement" stated in the Appendix or if not so stated then within six months of the completion of the contract works as defined in Clause (26) hereof. No further claim shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished.

22.6 The final certificate shall be based on the submission of final measurements or overall measurements of the work (to be taken if so directed by Corporation's Engineer) with all relevant details similar to 22.1 above. The CE may direct the Contractor to resubmit details if the same are found incomplete to issue the final certificate and his decision to accept the details is final and binding on the Contractor. Final Certificate shall be issued by the CE after the conditions are met with as per 22.4, 22.5, 22.6 and 26 and contractor's submission of **No Claim certificate cum receipt** as per the Proforma given in Appendix to Conditions of Contract.

23. ~~SECURED ADVANCE AGAINST MATERIALS~~

~~23.1 The Contractor shall be entitled to be paid advance along with interim bill against materials which are not perishable and which are in the opinion of Corporation's Engineer, required for the works and have been brought on site for incorporation in the work but have not been so incorporated and are safeguarded against loss due to any cause whatsoever, (refer clause no 17). The amount of such advance against materials shall be arrived at on the following basis:~~

~~a) 80% of the market value of materials required for the work and brought on site.~~

~~**OR**~~

~~80% of the cost of such materials (brought on site) as derived from the relevant accepted tender rate for the particular item involving such materials, whichever is lower.~~

~~b) Such advance payment made against materials shall be recovered from or adjusted from the interim bills as and when the materials are utilized in the work.~~

~~Examples of certain perishable materials on which no advance shall be paid are Sand, Paint, Bitumen, Hard Boards/Soft Boards and other paper products, Petroleum Products, Coal Tar, and Insulating Boards etc~~.

23.2 In case of dispute, the decision of the Chief Engineer on whether advance payment can be made against specific materials shall be final and binding.

24. UNFIXED MATERIALS AND EQUIPMENTS:

24.1 All tools, plants and materials brought to the site by the Contractor shall vest in the Employer and shall not be removed from the site of works except by permission of the Corporation's Engineer in writing. The Employer shall have a lien on these materials and plants.

25. REMOVAL OF IMPROPER WORK:

25.1 The Corporation's Engineer shall during the progress of the work have power to order in writing from time to time the removal from the work within such reasonable time or as may be specified in the order, of any materials, which in their opinion are not in accordance with the Specifications or instructions, the substitution of proper materials and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the Drawings and Specifications or Instructions and the Contractor shall forthwith carry out such an order at his own cost. In case of default on the part of the Contractor to carry out such an order, the CE shall have the power to employ other persons to carry out the same and all expenses consequent thereon or incidental thereto as certified by the EE shall be borne by the Contractor and may be deducted from any amounts due or that may become due to the Contractor.

26. VIRTUAL COMPLETION:

26.1 The work shall be completed in accordance with the Contract and to the entire satisfaction of Chief Engineer. All unused materials, tools, plants, scaffoldings, temporary structures, hutments and things belonging to the Contractor shall be removed and the site of works cleared of rubbish and all waste materials by the contractor at his own expenses and delivered up tidy to the employer. After completion of the work, the contractor will serve a written notice to the CE to this effect. The Chief Engineer after satisfying himself shall thereupon approve the virtual completion. The Defect Liability Period shall commence from the date of such certification.

27. DEFECTS AFTER COMPLETION:

27.1 The defects, shrinkage, settlements or other faults, which may appear within "the Defects Liability Period, stated in the "Appendix to the Conditions of Contract" or if not stated then, within 12 months after virtual completion of the work, arising on account of materials or workmanship not in accordance with the Contract shall, upon the directions in writing of the Corporation's Engineer and within such reasonable time specified therein, be amended and made good by the Contractor at his own cost unless the CE shall decide that he ought to be paid for such amendment and for making good, and in case of default, the CE may employ and pay other persons to amend and make good such defects, shrinkage, settlement or other faults, and all damages, loss and expenses consequent thereon or incidental thereto shall be recovered from any monies due or that may become due to the Contractor. The CE may in lieu of such amending and making good by the Contractors, deduct from any money due or that may become due to the Contractor, a sum to be determined by the CE equivalent to the cost of amending such work. Should any defective work have been done or materials supplied by any Sub-Contractor employed on the work, who has been nominated or approved by the CE as provided in Clause No.16 the Contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the Contractor and been subjected to the provisions of this Clause and Clause No.2 hereof. The Contractor shall remain liable under the provision of this Clause notwithstanding the payment of any Certificate or the passing of any accounts.

28. PROVISIONAL SUMS, APPLICATION OF:

28.1 For all the work listed under items for which provisional sums are provided in the tender, the CE reserves the right to invite separate tenders or select or order from any manufacturer or firms at his discretion and reserves to himself the right of paying direct to persons or firms for any such work. The Contractor will not have any claims over these items, but if tenders are invited for such items, he will also be invited to quote along with others.

28.2 If ordered by the CE, Contractor shall be required to carry out provisional sum items at the same conditions and rates as applicable for this Contract.

29. OTHER PERSONS ENGAGED BY THE EMPLOYER:

29.1 CE reserves the right to execute any work not included in this Contract, which he may desire to have carried out, by other persons and the Contractor shall allow all reasonable facilities and the use of his scaffolding and plant for the execution of such work, but is not required to provide any special plant or materials for the execution of such work except by special arrangement with the Employer. Such work shall be carried out in such manner as not to impede the progress of the work included in the Contract and the Contractor shall not be responsible for any damage or delay which may happen to or be occasioned by such work.

30. SUSPENSION BY THE CONTRACTOR:

30.1 If the Contractor except on account of any legal restraint upon the Employer preventing the continuance of the work, shall suspend the work or in the opinion of the CE shall neglect or fail to proceed with due diligence in the performance of his part of the Contract or if he shall make default in respect of Clause No.2, the Employer shall have the power to give notice in writing to the Contractor requiring that the work be proceeded within a reasonable manner and with reasonable dispatch. Such Notice shall purport to be a notice under this clause. After such notice is given, the Contractor shall not be at liberty to remove from the site of the work or from any ground contiguous thereto any plant or materials belonging to him, which shall have been placed thereon for the work and the Employer shall have a lien upon all such plant and materials to subsist from the date of such notice being given until the notice shall have been complied with. If the Contractor shall fail for 7 (seven) days after such notice given to proceed with the work as therein prescribed, the CE may proceed as provided in Clause No.31.

31. DETERMINATION OF CONTRACT BY EMPLOYER:

31.1 If the Contractor (being an individual or a firm) commit any “Act of Insolvency” or shall be adjudged as Insolvent or shall make an assignment or composition of the greater part in number or amount of his creditors or shall enter into a deed of assignment with his creditors, or being an Incorporated Company shall have an order made against him or pass an effective resolution for winding up either compulsorily or subject to the supervision of the Court or Voluntarily or if the official Assignee of the Contractor shall repudiate the Contract or if the official Assignee or the Liquidator in any such winding up shall be liable within 7 (seven) days after notice to him requiring him to do so, to show to the reasonable satisfaction of CE that he is able to carry out and fulfill the Contract and if required by the CE to give security therefore or if the Contractor (whether an Individual Firm or Incorporated Company) shall suffer execution to be issued or if the Contractor shall suffer any payment under this Contract to be attached by or on behalf of any of the creditors of the Contractors or if the contractor shall assign or sublet the Contract without the consent in writing of the CE first obtained or if the Contractor shall charge or encumber this Contract or any payment due or which may become due to the Contractor there under, or if the CE shall certify in writing that in his opinion the Contractor,

a. has abandoned the Contract, or

b. has failed to commence the work, or has without any lawful excuse under these conditions suspended the progress of the work for 7 (seven) days after receiving from the CE written notice to proceed, or

c. has failed to proceed with work with such due diligence and failed to make such due progress as would enable the work to be completed within the time agreed upon, or

d. has failed to complete the work within the stipulated date including authorized extensions or

e. has failed to remove the materials from the site or to pull down and replace the work within 7 (seven) days after receiving a written notice from the Corporation's Engineer that the said materials or work were condemned or rejected or

f. has neglected or failed persistently to observe and perform all or any of the acts, matters, or things, by this Contract to be observed and performed by the Contractor for 7 (seven) days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or

g. has to the detriment of good workmanship or in defiance of the CE's instructions to the contrary sub-let any part of the Contract.

then and in any of the said causes, the CE notwithstanding any previous waiver, after giving 7 (seven) days notice in writing to the Contractors, determine the Contract, but without thereby affecting the powers of the CE or the obligations and liabilities of the Contractor, the whole of which shall continue to be in force as fully as if the contract has not been so determined and as if the work subsequently executed had been executed by or on behalf of the Contractor. And further, the Employer, his agents or servants, may enter upon and take possession of the work and all plant, tools, scaffolding, sheds, machinery, steam and other power, utensils and materials, lying upon the premises or the adjoining lands or road and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the work or by employing any other Contractors or other person or persons to complete the work, and the Contractor shall not in any way interrupt or do any act, matter, or thing to prevent or hinder such other Contractor, other persons or person employed for completing and finishing or using the materials and plant for the work. When the work shall be completed or as soon thereafter as convenient, the CE shall give a notice in writing to the Contractor to remove his surplus materials and plant and should the Contractor fail to do so within a period of 14 (Fourteen) days after receipt thereof by him, the Employer may sell the same by public auction and shall give credit to the Contractor for the amount so realized. The CE shall thereafter ascertain and certify in writing under his hand what (if anything) shall be due or payable to or by the Employer for the value of the said plant and materials so taken possession of by the Employer and the expense or loss which the Employer shall have been put to in getting the work to be so completed, and the amount, if any, owing to the Contractor and the amount, which shall be so certified shall

thereupon be paid by the Employer to the Contractor or by the Contractor to the Employer, as the case may be and the Certificate of the CE shall be final and conclusive between the parties.

32. TERMINATION OF CONTRACT BY CONTRACTOR:

32.1 If payment of the amount payable by the Employer under any Certificate of the EE shall be in arrears as unpaid for 60 (sixty) days after notice in writing requiring payment of the amount with interest of aforesaid shall have been given by the Contractor to the Employer, or if the work be stopped for six months under order of the CE or by any injunction or other order of any Court of Law, then and in any of the said cases, the Contractor shall be at liberty to determine the Contract by notice in writing to the Employer and he shall be entitled to recover from the Employer payment for all the work executed and for any loss, he may sustain upon any plant or material supplied or purchased or prepared for the purpose of the Contract.

32.2 In arriving at the amount of such payment, the net rates contained in the Contractor's original tender shall be followed or where the same may not apply, valuation shall be made in accordance with Clause No.15 hereof.

33. DETERMINATION OF CONTRACT DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK:

33.1 If at any time after the acceptance of the tender, the Employer shall for any reasons whatsoever not require the whole or any part of the works to be carried out, the CE shall give notice in writing to the Contractor who shall have no claim to any payment of compensation or otherwise whatsoever on account of any profit or advantage which he might have derived from the Execution of the whole of the works.

The Contractor shall be paid at contract rates for the full amount of work executed and in addition:

a. The cost at site of all surplus approved materials collected for incorporation in the work, which the Contractor does not wish to retain and which shall thereafter become the property of the Employer.

b. Where the Contractor desires to retain the surplus of approved materials (excepting materials supplied by the Employer or obtained in Employer's name, which shall, in any case, be returned to the Employer) the cost of handling and cartage charges for removal from the site to a reasonable distance not exceeding 25 kms.

c. If upon the determination of the Contract under this condition, the Contractor is of the opinion that he has suffered hardship by reason of the operation of these conditions, he may refer the circumstances with full details to the Chief Engineer, who on being satisfied that such hardship exists or has existed, shall make such allowance, if any as in his opinion is reasonable, and his decision shall be final, conclusive and binding.

34. DISPUTES TO BE FINALLY DETERMINED BY CHIEF ENGINEER:

34.1 The Instruction, Decision, Opinion, Direction, Certificate or Valuation of the CE with respect to all or any of the matters under Clause (2), (3), (5), (6), (9), (14), (15), (18), (23), (27), (30), (31) and (33) hereof (which matters are herein referred to as EXCEPTED MATTERS) shall be final and conclusive and binding on the parties hereto and shall be without appeal. Any other Decision, Opinion, Direction, Certificate or Valuation of the CE or any refusal of the CE to give any of the same shall be subject to the right of Arbitration and review as given under Clause No.36.

35. SECURITY DEPOSIT AND PERFORMANCE GUARANTEE:

35.1 Amount towards Security deposit shall be calculated as per details given under Serial No.9 of "APPENDIX TO CONDITIONS OF CONTRACT" in the tender. Security Deposit can be either in Cash or in the form of Bank Guarantee.

In case of cash option, the EMD shall be retained as part of Security Deposit and balance Security Deposit shall be accumulated through retentions from Running Account Bills at 7.5% (maximum) of gross amount of bill. If the total amount / 50% of EMD is submitted in the form of Bank Guarantee and the contractor wants to avail the cash option i.e. the deduction of security deposit from the bills, then the contractor has to deposit a demand draft /pay order in the name of Life Insurance Corporation of India payable at Patna amounting to the total amount / 50% of EMD in lieu of Bank guarantee submitted towards EMD. Once this amount is deposited the contractor can avail cash option for security deposit and the bank guarantee submitted towards EMD shall be returned.

In case of Bank Guarantee option, the Contractor shall furnish one Bank Guarantee for full amount of Security deposit valid till end of defects liability period OR, two Bank Guarantees of like amounts each equal to half the Security deposit; one valid till virtual completion and the other till end of defects liability period.

35.2 Performance Guarantee under 9(b) of "Appendix to Conditions of Contract" shall be only in the form of Bank Guarantee valid up to scheduled date of completion.

35.3 The Bank Guarantee/s shall be from any Nationalised / Scheduled Bank preferably at place of work site or Zonal Headquarter of LIC within whose jurisdiction the work falls or where a Branch/Division of the Corporation exists.

35.4 Bank Guarantee/s (BGs) against Security Deposit (SD) and Performance Guarantee (PG) shall be executed as per the specimen pro-forma at Annexure B and C. Bank guarantee/s against Security Deposit and Performance guarantee shall be submitted within 21 (twenty one) days from the date of acceptance letter.

35.5 In case of failure by the contractor to furnish the Bank Guarantee against Performance Guarantee as per Cl.35.2 by the stipulated date or extended date if any, Employer shall without prejudice to

any other right or remedy available in law, be at liberty to cancel the tender and forfeit the 50% Earnest Money absolutely.

35.6 50% of the Security Deposit (cash option) shall be refunded after the certificate of virtual completion is issued to the contractor & provided that the employer has no claim for forfeiture of part or whole of the said deposit.

35.7 **Balance 50% of Total Security deposit will be retained with LIC of India till 5 year CAMC period of ACs (i.e five years after defect liability period) Alternately they can furnish a Bank Gurantee of equivalent amount of 50% of S.D with validity of five years after defect liability period plus six month claim period and after confirmation from the Bank, the 50% S.D will be released to agency**

If one Bank Guarantee in lieu of total Security Deposit is furnished, the same will be released only after the successful completion of CAMC Period of AC which is 05 years after Defects Liability period plus 6months claim period subject to any appropriations as aforesaid.

If two Bank Guarantees in lieu of Security deposit are furnished, the First Bank Guarantee will be released after the satisfactory completion of work and second shall be released after the satisfactory completion of CAMC Period of AC which is 05 years after Defects Liability Period plus 6months claim period subject to any appropriations as aforesaid. ~~Bank Guarantees towards Performance Guarantees (where applicable) shall be released after the virtual completion of work as given in appendix to conditions of contract.~~ Contractor shall keep the Security Deposit, where applicable, replenished to its full value whenever any recovery or appropriation there from occurs. The employer reserves the right to do so from any money(s) due to the contractor lying with them. The Contractor should note that no interest will be allowed on any part of the Security deposit. No deductions will be effected from the bills when the total security deposit is paid in the form of Bank Guarantee(s) and the E.M.D shall be refunded after acceptance of Bank Guarantee(s). In the event of failure by the contractor to submit Bank Guarantee(s) by the specified / extended date, recovery of Security deposit shall be effected from the R.A Bills. In all cases of Bank Guarantees, there shall be further provision of claim period of 6 months. If the contract period gets extended for any reason whatsoever, the contractor shall obtain the required extensions to the Bank Guarantee(s).

35.8 If one Bank Guarantee in lieu of total Security Deposit is furnished, the same will be released only after the successful completion of Defects Liability period subject to any appropriations as aforesaid.

35.9 If two Bank Guarantees in lieu of Security deposit are furnished, the First Bank Guarantee will be released after the certificate of Virtual completion is issued to the contractor and second shall be released after the satisfactory completion of Defects Liability Period subject to any appropriations as aforesaid.

35.10 Bank Guarantees towards Performance Guarantees (where applicable) shall be released after the virtual completion is issued.

35.11 Contractor shall keep the Security Deposit and Performance Guarantee, where applicable, replenished to its full value whenever any recovery or appropriation there from occurs. The employer reserves the right to do so from any money(s) due to the contractor laying with them.

35.12 The Contractor should note that no interest will be allowed on any part of the Security deposit.

35.13 No deductions will be effected from the bills when the total security deposit is paid in the form of Bank Guarantee(s) and the E.M.D shall be refunded after acceptance of Bank Guarantee(s).

35.14 In the event of failure by the contractor to submit Bank Guarantee(s) by the specified / extended date, recovery of Security deposit shall be effected from the R.A Bills. However, where the contractor fails to furnish Bank Guarantee against Performance Guarantee the matter shall be dealt with as per Cl. 35.5 above.

35.15 In all cases of Bank Guarantees, there shall be further provision of claim period of 6 months. If the contract period gets extended for any reason whatsoever, the contractor shall obtain the required extensions to the Bank Guarantee(s).

36. SETTLEMENT OF DISPUTES, ARBITRATION:

36.1 All Disputes and Differences of any kind whatsoever arising out of or in connection with the Contract or the carrying out of work (whether during the progress of the work or after its completion and whether before or after determination, abandonment or breach of contract) shall be referred to a Standing Committee consisting of 1. Retired High Court Judge and 2. Members from engineering fraternity retiring as senior Engineer from Government/ Government Undertaking. The Committee will be constituted by the Chairman, LIC of India.

36.2 The claims arising out of the Contract will be placed before the Committee once in a quarter and decision will be conveyed to both the contractually agreed parties.

36.3 Either of the Party on being dis-satisfied with the decision may approach to a Three Member Arbitral Tribunal, one each will be appointed by Either Party and 2 appointed Arbitrators will appoint 3rd Arbitrator who will act as Presiding Arbitrator.

36.4 Executive Director (Engg.) will appoint the Arbitrator on behalf of LIC of India. The Arbitration shall be conducted in accordance with Arbitration and Reconciliation Act 1996 as amended by the Arbitration and Reconciliation (Amendment) Act 2015 (3 of 2016) and any other amendment thereafter if any.

36.5. The Contractually Agreed Parties hereby also agree that the Arbitration under this clause shall be a Condition Precedent to any Right of Action in Law of Court under the Contract.

37 Execution & Installation

(i) As the work is to be carried out in existing occupied building, the actual functioning of the existing system cannot be put under shut down. Therefore, the execution of this work has to be meticulously planned and executed in consultation with site engineer in such a manner that minimum cooling of the building is not hampered.

(ii) Mostly the work will be carried out after office hours and on Saturdays, Sundays and Holidays. Every day morning the working site office work stations, and working place must be kept clean and suitable for running office.

(iii) The work shall be taken for execution only after the entire material has been supplied at site.

(iv) Before commencement of execution of work, the tenderer shall plan the system for laying copper tubing, outdoor units location and AHU units etc and get the same approved from LICI.

38 : Terms & Conditions of Comprehensive Annual Maintenance Contract :

1. **After completion of one year defect liability period, the agency has to enter in CAMC agreement for consecutive 5 years. Quarterly CAMC charges will be paid upon satisfactory completion of CAMC as per the terms & conditions as detailed in tender. Quarterly CAMC bill must be submitted within the 15 days after completion of servicing. Inspection/ Service Reports must be enclosed with the CAMC bill. Without Inspection / Service report CAMC bill will not be settled.**
2. **Each Installation has to be inspected, tested thoroughly once in 3months and the agency has to give report on their inspection. Inspection report duly signed by the LIC Officials and has to be submitted along with the CAMC bill.**
3. **During maintenance/inspection if any equipment found not working or damaged, the same will have to be repaired/replaced within 02(two) working days by the agency at their own cost.**
4. **If any installation found faulty / not working during the contract period, the same has to be attended within 02(two) working days from the date of intimation ZO.**
5. **It's the responsibility of the agency to keep the AC System healthy throughout the contract period.**
6. **The agency should attend all the break down calls with in 48 Hrs. during DLP and CAMC period Please note that all the above terms & conditions will also be applicable during Defect liability period of 01 year (12 months).**

GENERAL INSTRUCTIONS TO CONTRACTORS

2. INSPECTION OF SITE:

2.1 The Tenderer shall visit and examine the site of work and satisfy himself as to the nature of the existing roads or other means of communication, the character of the soil and of the excavations, the correct dimensions of the work and facilities for obtaining materials and shall obtain generally his own information on all matters affecting the execution of the work. No extra charge made, in consequence of any misunderstanding or incorrect information on any of these points or on the grounds of insufficient description will be allowed. All expenses incurred by the Tenderer in connection with obtaining information for submitting this tender including his visits to site and efforts in compiling the Tender shall be borne by the Tenderer and no claims for reimbursement thereof shall be entertained.

18. MINIMUM WAGES ACT:

18.1 The Contractor shall pay rates of wages and observe hours of work and conditions of employment to existing rules under Minimum Wages Act. Further, it shall be Contractor's responsibility to ensure that he pays his workmen wages, which are not lower than the minimum prescribed by the Union Government and State Government in which area this Contract, is being operated.

32. TAXES, DUTIES, LEVIES AND DEDUCTION AT SOURCE:

32.1 The Contractors shall be responsible to pay all statutory levies/taxes imposed by the State and Central Government from time to time. It is deemed that the rates quoted by the contractor for each item of works includes all applicable taxes except GST on works contract which shall be paid by LICI as applicable from time-to-time as per notification of Government of India.

32.2 Deduction at source of Income tax, all other statutory taxes as applicable and labour cess shall be made by LIC of India as per statutory provisions prevailing from time to time, from the running account/ final bill and remitted to the concerned taxation authorities / State Government on behalf of the contractor.

32.3 The contractor shall mention the following LIC of India GSTIN Number according to State of work site in their bill.

FOR BIHAR GSTIN NUMBER : 10AAACL0582H2Z0
FOR JHARKHAND GSTIN NUMBER : 20AAACL0582H1Z0
FOR ODISHA GSTIN NUMBER : 21AAACL0582H1ZY

32.4 The vendor needs to display the invoice on the GST portal and remit the tax to the Govt. within specified period.

32.5 The measurement **sheets (Excel format)** along with the abstract are to be checked, corrected and accepted by the vendor and then only invoice with zero correction will be raised and uploaded by the vendor on GST portal.

32.6 The vendor should quote their rate considering all taxes/duties/levies/ labour welfare cess etc. which are not subsumed in GST but excluding GST on works contract as applicable which will be paid extra at the rate prevailing at the time of billing. It is also advised to quote the rate after considering the input tax credit advantage and adjusting / deducting the same in the quoted rate/amount.

32.7 GST on works contract will be paid extra along with Bill payment as per applicable rate of GST at the time of billing.

LETTER TO BIDDER FROM THE CHIEF ENGINEER

To,

_____

_____

Dear Sir / Sirs,

Re : Air-conditioning of the Branch office ARA under DO-2 Patna – Invitation of Limited E-Tender on Percentage Rate basis for SITC Air Conditioners

1) We hereby publish the TENDER on e-Tendering Portal (Website) through **www.tenderwizard.com/LIC** in **Electronic Mode** hereinafter referred as "**e-Tendering**" and consisting of following :

(a) **BID I : EMD BID**
(b) **BID II : FINANCIAL BID**

Please note that copy of above e-Tender can be downloaded from above portal (website) and should be mandatorily submitted in **Online Electronic Mode** hereinafter referred as "**Online Offer**". The submission of Online offer duly Encrypted & Digitally Signed on above portal should be in prescribed Electronic Forms (Online) available on above portal for respective tender in Online Envelope(s) on or before **As per the Key Dates mentioned in the tender document and online portal for above tender.**

The bidders should submit required Tender document Fee and Earnest Money Deposit in a manner/mode as mentioned in e-Tender process (ref: 1.0 XI and XII of Qualification Notice). Tender document fee of Rs 500.00 plus 18% GST i.e. total **Rs 590 (Rupees Five Hundred ninety Only)** and **Earnest Money Deposit of Rs 22800..00 (Rupees Twenty Two Thousand Eight Hundred only)** shall be submitted separately.

a) Tender Processing fee (non-refundable) of Rs.500.00 plus 18% GST i.e. total **Rs 590.00 (Rupees Five hundred Ninety only)**

(i) In the form of Cash depositing the same in LIC ECZO Zonal Office Cash Counter during Cash hours of working days and obtaining Receipt (MR) which has to be submitted with Bid – I
OR
(ii) In the form of Demand Draft/Pay Order/Banker's Cheque in favour of Life Insurance Corporation of India payable at Patna
OR
(iii) Payment through NEFT mode directly to LIC Account as detailed below :

Name of Bank :	: AXIS BANK LTD.
Branch	: Main Branch, Patna
Account No.	: 142010200012704
IFSC No.	: UTIB0000142
Account Type	: Current

b) Earnest Money Deposit of **Rs 22800..00 (Rupees Twenty Two Thousand Eight Hundred only)** shall be submitted in the following form:-

(i) In the form of Cash depositing the same in LIC ECZO Zonal Office Cash Counter during Cash hours of working days and obtaining Receipt (MR) which has to be submitted with Bid – I

OR

(ii) In the form of Demand Draft/Pay Order/Banker's Cheque in favour of Life Insurance Corporation of India payable at Patna

OR

(iii) In the form of Bank Guarantee (as per proforma) issued by any Nationalised / Scheduled Bank preferably at Patna or where a Branch / Division exists.

OR

(iii) 50% amount In the form of Demand Draft/Pay Order/Banker's Cheque in favour of Life Insurance Corporation of India payable at Patna and 50% amount In the form of Bank Guarantee (as per Performa) issued by any Nationalised / Scheduled Bank preferably at Patna or where a Branch / Division exists

OR

(iv) Payment through NEFT mode directly to LIC Account as detailed below :

Name of Bank :	: AXIS BANK LTD.
Branch	: Main Branch, Patna
Account No.	: 142010200012704
IFSC No.	: UTIB0000142
Account Type	: Current

(c) BIDs will be received at the office of Chief Engineer at above address on or before As per the Key Dates and the e-Tenders will be opened at As per the Key Dates in the presence of contractors or accredited representatives, who wish to attend the online Tender Opening process. The bidders can view the Tender Opening details through their respective Login IDs on the above mentioned e-Tender portal (Website). The Tenderer should ensure that their tender is received Online Electronically on or before the due date and time as specified in "Key Dates" in the Tender Document and above mentioned Portal (website). Please note that above e-Tendering System is an automatically time locked system which will be locked immediately as soon as due date and time is over and will not accept any offer after that. So, the tenderers are strictly advised to do their process well before the due date and time to avoid any such instances.

(iii) The Guidelines to Submit tenders on Electronic Tendering System (ETS) is part of **BID -I** of the Tender document. The tenderers are advised to carefully read the above document for understanding of e-Tendering System. The above Annexure will supersedes all the terms & conditions mentioned for submission of tender in document.

(iv) The Life Insurance Corporation of India does not bind itself to accept the lowest or any tender.

Yours faithfully,

CHIEF ENGINEER

LETTER FROM BIDDER TO CHIEF ENGINEER

TO BE SUBMITTED ONLINE ON OR BEFORE ON As per the Key Dates

Date:

From:
……..

……..

……..

……..

To
The Chief Engineer,
Life Insurance Corporation of India
East Central Zonal Office
Jeevan Deep, Exhibition Road,
Patna - 800001

SUB Air-conditioning of the Branch office ARA under DO-2 Patna – Invitation of Limited E-Tender on Percentage Rate basis for SITC Air Conditioners

Dear Sir

1) Having examined the Qualification Form, Selection Criteria , Technical Specifications, schedule of Quantities, Detailed Drawings, Specifications, Conditions of Contract etc. included in the tender document for the **Percentage Rate Contract** relating to the above work, having visited/examined the site of the existing premises, having acquired the requisite information relating thereto as effecting the tender invited by you on behalf of the Life Insurance Corporation of India, I/We, the undersigned hereby offer to carry out the above mentioned work on Percentage Rate basis in strict accordance with the Contract Conditions and Specifications.

I/We, undertake to complete and deliver the whole of the works within a period as specified in Appendix to the Conditions of Contract from the date of issue of intimation from you that the tender has been accepted and upon receiving possession of the site. I/We shall be under the obligation to complete the entire work within the period of completion failing which to pay the sum as stated in the Appendix to the Conditions of Contract for every week that the works shall remain incomplete, damages as compensation subject to the conditions of contract relating to extension of time.

2) I/We enclose herewith my/our bid with an Earnest money remittance of **Rs 27800..00 (Rupees Twenty Seven Thousand Eight Hundred only)** in the appropriate format as specified in BID-I (Prequalifying Bid). I/We, hereby agree that part of this sum shall be forfeited by the Life Insurance Corporation of India in the event of my/our tender being accepted and I/We fail to execute Contract when called upon to do so.

3) In the event of the bid being accepted, I/We, agree to the retention of my/our EMD as a part of Security Deposit and the balance amount of Security Deposit to be recovered at 7.5% of Gross Value of work done from my / our Running Account Bills. If the total amount / 50% of EMD is submitted by me/us in the form of Bank Guarantee and I/We want to avail cash option i.e. deduction of security deposit from the bills, then I/We have to deposit a Demand draft/Pay order in

the name of Life Insurance Corporation of India payable at Patna amounting to total amount / 50% EMD in lieu of Bank Guarantee submitted towards EMD. Once this amount is deposited then I/We can avail cash option for Security deposit and the Bank Guarantee submitted towards EMD shall be returned to me/us.

OR

I/We, agree to furnish a lump sum Bank Guarantee for total Security Deposit or two Bank Guarantees each with 50% value (as per proforma) issued by any Nationalised / Scheduled Bank preferably at Patna or where a Branch / Division of LIC of India exists as per specimen given in **Annexure "B"** to Conditions of Contract, within 21 (twenty-one) days of acceptance of tender.

5) I/We, note that the Earnest Money Deposit of **Rs 27800..00 (Rupees Twenty Seven Thousand Eight Hundred only)** would be refunded to me/us :

a) On expiry of the validity of the tender or earlier at the discretion of Chief Engineer in case my/our bid is not accepted and

b) In case my/our tender is accepted, after I/We, furnish Bank Guarantee as mentioned above.

6) I/We, agree,

a) in case my/our tender is withdrawn before expiry of the validity period or before the issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the Department, in such case 25% of the EMD will be forfeited by the department.

b) in case my/our tender is accepted and the Performance Guarantee, if applicable, is not submitted within the prescribed period or approved extended period, 50% of the EMD will be forfeited automatically without any notice.

c) in case of forfeiture of Earnest money as prescribed above [6(a) and 6(b)],the I/We shall not be allowed to participate in the retendering process of the work.

Yours faithfully,

(SIGNATURE OF THE CONTRACTOR)
Name and Seal
NAME OF THE PARTNER OF THE FIRM
OR
NAME OF THE PERSON HAVING POWER OF ATTORNEY TO SIGN THE CONTRACT
(CERTIFIED TRUE COPY OF THE POWER OF ATTORNEY SHOULD BE ATTACHED)

APPENDIX TO CONDITIONS OF CONTRACT

SUB: SITC of Air Conditioners including Electrical Installation work for **Proposed Air-conditioning of the SO Bikramganj (BO Dehri- on- Sone) & SO Dighwara (BO Chapra -1) under DO-2 Patna –**

ESTIMATED COST : Rs .1284654.00
PERIOD FOR COMPLETION : As detailed in work order
EARNEST MONEY DEPOSIT : Rs.25700.00 (Rupees Twenty Five Thousand Seven Hundred only) (To be submitted in Stipulated form)

Sl. No.	Clause Nos.	Description	Remarks
2	13	Date of commencement	Either 21 (twenty one) days from the date of acceptance letter issued to the contractor **OR** The day on which contractor is instructed to take possession of the site, **whichever is earlier**
3	13 & 26	Date of completion	30 (Thirty) Days from the date of commencement or as specified in work order.
4	19.1	Liquidated damages / Compensation in the form of Penalty	Compensation in the form of penalty for delay of the work: **Quantum of LD per week of delay will be 0.5% of the Contract sum per week , subject to Maximum of 10%.** Progress of the work will be reviewed according to the physical milestones in tune with the T&P Chart and should be ensured that actual progress of work corroborates with the anticipated progress of work during the particular period. If the progress of work is delayed due to lack of initiative by the Contractor, it will lead to imposition of LD, leviable at intermediate stages on failing to achieve milestones.
5	21	Period of final measurement	**45 (Forty Five)** days from the date of completion of contract
6	22	Interim certificate	**5.89 LAKH**
7	22	Period of honouring interim certificate	**20 (Twenty)** days
8	22	Period of honouring final certificate	**90 days** from the date of submission of final bill with details.
9	27.1	*Defects Liability Period (DLP)*	12 Months from the date of virtual completion of work
10	35	*a) Security Deposit*	5% of the Accepted Tender Amount **(50% of Total Security deposit will be retained with LIC of India till 5 year CAMC period of ACs (i.e five years after defect liability period) Alternately they can furnish a Bank Guarantee of equivalent amount of 50% of S.D with validity of five years after defect liability period plus six month claim period and after confirmation from the Bank, the 50% S.D will be released to agency)**

Sl. No.	Clause Nos.	*Description*	Remarks
11	35	*Recovery of Security Deposit*	In case of Cash option, the Security Deposit shall be recovered from R.A. Bills at 7.5% of Gross amount of bill till the sum along with sum already deposited as EMD equals the total security deposit. If the total amount / 50% of EMD is submitted in the form of Bank Guarantee and the contractor wants to avail the cash option i.e. the deduction of security deposit from the bills, then the contractor has to deposit a demand draft /pay order in the name of Life Insurance Corporation of India payable at Patna amounting to the total amount / 50% of EMD in lieu of Bank guarantee submitted towards EMD. Once this amount is deposited the contractor can avail cash option for security deposit and the bank guarantee submitted towards EMD shall be returned. Altenatively, Security Deposit can be furnished in the form of one or two (of like amount) Bank Guarantee(s) as per specimen on any nationalized/ scheduled Bank preferably at Patna. If one BG is submitted for full amount, it shall remain in force till DLP is satisfactorily completed. If the Contractor furnishes two BGs of like amount, one shall remain in force till the period of virtual completion of work and issue of Virtual Completion Certificate and second shall remain in force till the Defect Liability Period. In all cases there shall be further provision of claim period of 6(six) months for the BG. The BGs must be deposited simultaneously within 21 days of intimation to the contractor orf acceptance to tender or date as may be extended by the Competent Authority. No deductions will be effected from the bills when total Security Deposit is paid in the form of BG(s) and EMD shall be refunded after acceptance of BG(s).
12	37	*Interest on Lump sum Advance*	Not applicable
13	17.5	*Contractor's All Risk Policy inclusive of Third Party Liability*	The Contractor's All Risk Policy will be for full amount of the Contract Value and Third Party liability will be 7.50% of the contract value. The date for submitting the renewed Insurance Policy, if any will be 15 days prior to the last of expiry of the existing policy, failing which LIC of India may insure/renew insurance and apply penal cost on the contractor i.e. Premium Charges + Rs.10,000.00 as Admin charges + Rs 25,000.00 as penalty. Third Party liability Policy can be Standalone or can be along with CAR Policy for specified value.

Sl. No.	Clause Nos.	*Description*	Remarks
14	17.6	*Workmen's Compensation Policy*	The contractor should obtain the Workmen's Compensation Policy as mutually decided by LIC of India and Contractor depending on labour (skilled/unskilled) involvement, approved by Competent Authority. The date for submitting the renewed Insurance Policy, if any will be 15 days prior to the last date of expiry of the existing policy, failing which LIC of India may insure/renew insurance and apply penal cost on the contractor i.e. Premium Charges + Rs. 10,000.00 as Admin charges + Rs 25,000.00 as penalty.
15	22.6	*No Claim Certificate*	To be given on Contractors letter head as per specimen given below.
16	35	*Claim for Refund of SD/ RMD*	After the completion of contract period including extension if any
		Water & Electricity Charges	Not applicable

TECHNICAL SPECIFICATION FOR ELECTRICAL WORKS

SPECIFICATION FOR ELECTRICAL INSTALLATION WORKS IN L.I.C.I. BLDGS.

SUBJECT TO THE GENERAL CONDITION OF CONTRACT IN FORCE

(A) GENERAL

1. The installations shall generally be carried out in conformity with the Code of Practice for electrical wiring installation (system voltage not exceeding 650 V. viz I.S. 730. 1963 or the latest revision thereof.

2. **Definition:**

As given in I.S. Code of Practice shall apply.

3. **Pressure and frequency of supply :**

All current consuming devices shall be suitable for 433 V., 3phase, 50cycle A.C. supply.

4. **System of wiring :**

i) The wiring shall be carried out as per schedule. Power wiring must be in separate PVC conduit and shall be kept separate and distinct from lighting wiring. All wiring must be done on the distribution system with main and branch distribution board at convenient centers and without isolated fuses. All conductors shall run as far as possible along the walls and ceilings so as to be easily accessible and capable of being thoroughly inspected. The contractor shall arrange beforehand the balancing of circuits in consultation with Electrical Engineer of L.I.C.I.

ii) Within one month of taking over of the installation, the contractor shall submit to L.I.C.I. 3sets of completion drawings of the Electrical Installation in corpora ting all modifications made from time to time including cable & conduit lay-outs to the satisfaction of the Electrical Engineer of L.I.C.I. & the wiring plans shall be deemed to be “Drawings” within the meaning of the term as used in the general conditions of contract.

5. **Conductor :**

The conductors shall be of copper or otherwise stated in tender and shall be either PVC insulated or PVC insulated PVC sheathed. The minimum sections of conductors used for wring of light and plug points shall be 1.5 sq mm. Single core wires shall only be used.

6. **Cables:**

i) All cables including flexible cables used shall be ISI approved and confirming the ISI specifications.

ii) Twin flexible cable shall be of minimum section area of 14/0.0076 and PVC insulated.

iii) Wires as per specification of materials.

7. **Fall of Potential:**

The cross sectional area of all conductors inside buildings shall be so proportioned to their lengths that the drop in pressure between the main fuses and their furthest point shall not exceed two percent, with all the consuming devices in use.

8. Rating of Lamps and Fans:

In estimating the current to be carried by any conductors glow lamps are to be rated, as of 4 and 1.25 watts per candle power for carbon and metallic filament lamps respectively where the conditions are known, otherwise at 40 watts except in the case of gas filled lamps. Ceiling fans are to be rated 60 watts; table fans at 60 watts unless actual values, are known or specified.

9. Test :

The installation with fittings complete shall before current is switched on satisfactorily pass the following tests:

The whole of the lamps and appliance having been connected to the conductors and all switches and fuses being 'on', a pressure not less than twice the intended working pressure subject to a limit of 500 volts shall be applied and the insulation resistance of the whole or any part of the installation to earth must not be less in Mega ohms than 25 divided by the number of points as defined above. With all lamps and appliance removed from the circuits a similar test between poles may be demanded, provided that during the rainy season half the above test value will be accepted. Where any appliance referred to is a motor larger than one-half B.H.P. the insulation resistance of that particular circuit must be greater than one Meg ohm.

10. Joints and Looping Back:

No joints shall be allowed in conductors. Neutral shall be looped from point to point whereas the live wires shall be looped in the switch board only from switch to switch.

11. Switches:

i) All main switches (other than those of iron clad pattern) carrying over ten amperes shall be fitted for back connections.

ii) All switches and circuit breakers shall be constructed in accordance with the I.E.E. 'wiring rules' 8th, edition no 67, or its latest version, provided also that springs shall be either of phosphor bronze, or if of steel, shall be copper or nickel plated; & that handles shall be so fastened that do not tend to unscrew or become loose (see clause 16).

12. Control at point of Entry of Supply:

There shall be one main switch and one main fuse on each pole of each main circuit (other than the neutral conductor of a 3-wire circuit) at the point of entry of the supply. The switches must be linked.

13. Distribution Boards:

i) Main distribution board shall be metal clad and shall be provided with an iron clad switch and fuse on each pole of the circuit (MCCB / Switches).

ii) Branch distribution board shall be provided with one fuse/ MCB for each circuit and one common neutral bar. Maximum number of points to be wired on each circuit shall be 6.

iii) Switches and fuses of opposite polarity shall be mounted on separate bases with a shield of non-ignitable insulating material between the bases when placed one above the other.

iv) In wiring a branch distribution board the total number of points shall be divided as far as possible evenly between the numbers of ways of the board. A spare circuit shall be left for future extensions.

v) MCB / Fuses shall be of approved materials and each circuit shall be clearly numbered from left to right in conspicuous figures to correspond with the wiring plans.

vi) Two spare fuse carriers / MCB per main branch board shall be supplied for replacements.

14. Passing through the walls

I) Except as laid down in clause 87 where conductors pass the walls, one of the following alternative methods shall be used.

A hole of suitable area shall be made in the wall through which the casing or conductor shall be carried so as to allow of an air-space of not less than one inch on three sides of the casing or conductors as the case may be or the conductors shall be carried in approved heavy gauge solid drown or lap welded conduit tube on porcelain ducts. Where the supply is alternating current, the conductors of the circuit must be bunched.

ii) Where a wall tube passes outside a building so as to be exposed to the weather, the outer end shall be bell mounted and turned downwards.

15. Branch Switches (see clause – 11) – In installation supplied from a three wire system, all branch switches shall be placed on the outer wires, switches (Other than those for multiple control) controlling not more than 10 amperes shall be of the Modular type switches shall be 'ON' when knob is down. Where the specified position of branch switches is altered, any such alterations of position after fixing will be paid for.

16. Ceiling Rose and Wall Sockets – Three pins Ceiling roses, and wall sockets shall not contain fuse terminals. Wall sockets shall comply with the requirements of the Bureau of Indian Standards.

17. Fittings. Where conductors are required to be threaded through tubes or channels formed in the metal work of fittings, these must be free from sharp angles or projecting edges and of such a size as will enable them to be wired with the conductors used for the final sub-circuits without removing the braiding taping or outer covering. As far as possible all tubes or channels should be

for sufficient size to permit of 'looking back'. Where with approval of the Electrical Engineer of L.I.C. 'Electrolytic copper' wire is used for wiring fittings. The sub-circuit leads must terminate in a ceiling rose or connector from which this wire will be carried into the fittings. Flexible wire must not be used for wiring fittings, except portable fittings. All fittings must have not less than a half inch male nipple. Fittings and lamp holders for gas fitted lamps shall be adequately ventilated.

18. **Lamp holders**-Lamp holders for use on brackets, etc. shall have not less than a half inch female nipple and all those for use with flexible pendants shall be provided with cord grips. All cases must be solid and substantial thin case export type not being admissible. Edison screw holders will not be accepted for lamps below 100 watts.

19. **External and Road lamps** ; External and Road Lamps shall have weather proof fittings of approved design so as to effectually prevent the admission of moisture. An insulating distance piece of moisture proof materials must be inserted between the lamp holder nipple and that of the fitting. Flexible cord conductors and cord grip lamp holders must not be used where exposed to the weather. In verandahs and similar exposed situations rod pendants or ceiling plates shall be used.

20. **Lamps:** All glow lamps unless otherwise specified in the special conditions of contract shall hung at a height of nine feet above the floor level. Metal filament lamps shall be made of drawn wire only.

21. **Fans and Regulators**

(I) (a) All ceiling fans shall be suspended from a hook or shackle and insulated from the same. All joints in the suspension rod shall be screwed and all joints or bolts in connection therewith shall be additionally secured by means of split pins.

(b) The canopy and wood block at the top of the suspension rod shall effectually hide the suspension.

(c) The leading in wire shall be not smaller than 3/22 S.W. G. and shall be protected from being cut.

(d) All fans shall be free from sparking, noise oil throwing and excessive heating.

(ii)(a) All fans shall be hung nine and half feet above the floor or as directed by the supervising officer.

(b) All fans shall be capable of running at full speed for one month without additional oiling and shall not overheat after eight hours continuous run at full speed.

(c) Each fan shall have a speed regulator of Electronic type.

22. **Attachment of Fittings and Accessories** :

i) In other than conduit wiring all ceiling roses, wall sockets, switches, regulators, brackets, pendants and accessories attached to walls or ceiling shall be mounted on suitable PVC Base plate.

23. Interchangeability :

Similar parts of all the switches, lamp holders, distributing boards, ceiling roses, brackets, pendants fan and all other fittings of the same type shall be interchangeable.

B. CONDUIT SYSTEM

1) **Conduit to be continuous** – Conduit shall be of approved pattern and manufacture and in accordance with the specification of the Bureau of Indian Standards & relevant IE rules.
2) **Bunching of Wires** – The wires of a circuit may be bunched together in a conduit, and if the supply is alternating current, they must be bunched
3) **Junction in Conduit** – The lengths of conduit shall be joined by means of push fit joints or other approved joints. The greatest care shall be taken in preparing the conduit that no sharp edges or burrs are left which could damage the Insulation. The Elec. Engineer with a view to ensuring that the above proviso has been carried out, may require (if he should consider if necessary) that the separate lengths of conduit etc. after they have been prepared shall be submitted for inspection before being fixed.

4) **Fixing of Conduit –** The PVC conduit shall be fixed to the surface of walls, secured to plugs, arranged as in clause 15 by saddles and round-headed screws. No conduit shall be buried beneath the surface of the masonry unless so specified or approved by the Electrical Engineer, L.I.C.

5) **Bends of Conduit –** The conduits shall be brought round the angles of walls by means of bends or elbows as may be directed.
6) **Outlets-** All outlets for fittings, switches, etc. shall be equipped with an approved outlet box.

7) **Conductors –** All conductors used in conduit wiring shall be stranded

8) **Erection and Earthing of conduit** – The whole system of conduit shall be erected and completed before the conductors are drawn in. In conduit system, the pipe must be continuous when passing through walls or floors, and no other form of insulating or protecting tube is required.

Specifications for the Concealed Conduits in slab /wall columns etc. for electrical main / sub main / point wiring; will be as under :

i. Rigid PVC conduit of Medium class ISI marked and corresponding PVC conduit accessories.

ii. Special deep junction boxes – 75 mm deep to be laid in the slab / ceiling.

iii. The rectangular junction boxes wherever provide shall be made out of 16 gauge M.S. Sheets and painted with two coats of ready mixed oil paint of approved shade over a coat of red oxide primer.

iv. Make of conduits to be used should be of ISI marked and as per list of Electrical Materials.

v. **The electrical installation work shall be carried out through a Licensed Electrical Contractor. The name of licensed electrical contractor shall be get approved from the competent authority well in advance before commencement of the work.**

vi. **INSTALLATION OF CONDUIT:**

All conduits including bends, unions, junction boxes, etc. shall be cleaned before they are fixed in position. Conduits which are to be taken in the ceiling slab shall be laid on the prepared shuttering work of the ceiling slab before concrete is poured. The conduits shall be properly fixed into the sockets, bends, junction boxes, outlet boxes and shall be made watertight by using proper sealant recommended by the manufacturer. The conduits in ceiling slab shall be straight as far as possible, to facilitate easy drawing of wires through them. Before the conduits are laid in the ceiling, the positions of outlet points, point control junction boxes shall be set out clearly so as to minimize offsets and bends.

Conduits recessed in walls shall be secured rigidly by means of steel hooks/staples at not more than 0.6 meter intervals before conduit is concealed in the walls. All chases, grooves shall be neatly made to proper dimensions to accommodate the required number and size of conduits. The outlet boxes, point control boxes, inspection and draw boxes shall be fixed as and when conduit is being laid. The recessing of conduits in walls shall be so arranged as to allow at least 12 mm plaster to cover the same. All grooves, chases, etc. shall be refilled with cement mortar and finished up to the wall surface before plastering of walls is taken up by the Contractor. Where conduits pass through expansion joints in the buildings, adequate expansion fittings or other approved devices shall be used to take care of any relative movement. Wherever conduits terminate into points control boxes, distribution boards, etc, conduits shall be rigidly connected to boxes, boards, etc. Running joints in conduits wherever necessary shall be rigidly held in aligned position. After conduits, junction boxes outlet boxes, etc. are fixed in position their outlets shall be properly plugged with PVC.

Stoppers or with any other suitable materials so that water, mortar, vermin or any other foreign material do not enter into the conduits system.

Draw box junction box, point control boxes, etc, shall be provided with bushes of PVC or rubber, after the conduit ends are properly filed to remove the burrs and sharp edges. Concealed conduit laying above false ceiling shall be executed in a similar manner described above. Wherever called for, surface conduit system shall be adopted with PVC conduits being fixed on to the wall surfaces, ceilings, etc., with saddles, clamps and screws.

Conduit shall be run in square and symmetrical lines with proper drawing and ventilation. Before surface conduits are installed, the exact route shall be marked at site and the approval of the Employer's Engineer shall be obtained.

Conduit shall be concealed wherever specified in ceiling, walls, etc. as required. The conduits shall be laid in ceiling slab before pouring of Concrete. Care shall be taken to ensure that conduits are not displaced during the process of pouring and consolidating the Concrete.

The following precautions shall be observed while installing the conduits:-

a. As far as possible bending shall be done at site in a proper manner.

b. Where a number of conduits converge, a large M.S. box shall be used to avoid crossing of conduits. Where conduits are installed in straight runs, draw boxes will be provided at centers not greater than 15 meters on straight runs and at every change in direction. No boxes will be provided in voids where access cannot be readily obtained.

The rate for rigid P.V.C. conduit sleeves shall include for recesses and holes, etc. in brick work for electrical conduits as shown on drawings and as directed on site and making good the same.

Section-I

Specifications for LT (1.1 KV Grade) Cables

1 Scope:

This specification covers supply, testing at works, supply at site, installation, termination, jointing, connection, testing at site, commissioning and handing over of 1.1 KV grade Cables.

2 System :

The 1.1 KV grade cables are to be used in under ground distribution system with normal system voltage of 415 V, 50 Hz, 3 phases, 4 wire systems.

3 Applicable standards:

Cables to be supplied under this specifications shall be with Copper or Aluminum conductor as specified, in drawings or Bill of Quantities, PVC insulated and PVC sheathed, armored and with an outer PVC protective sheath, heavy duty type and shall confirm to,

IS 1554 (Part I) 1976: PVC insulated electric cables.

IS 1753: Aluminum conductors for insulated cables.

IS 3961: Recommended current ratings for cables.

4 General requirements:

4.1 All cables shall be new without any kinks or visible damage. The manufacturers name, insulating material, conductor size and voltage class shall be marked on surface of the cable at distance not exceeding 1 M.

4.2 Procurement of cables shall be on the basis of the actual site measurements and the quantities given shall be regarded as a guide. Before procurement of the cables, the contractor shall submit the detailed measurement sheet, based on site measurement showing the various cable lengths and after approval of the same place orders for the cables.

4.3 Cables shall be tested at factory as per IS requirement. The tests shall incorporate routine tests, type tests and acceptance test. The Contractor shall produce the certificate for type test.

4.4 The cables shall be of one of the makes mentioned in the list of approved materials and with ISI mark.

4.5 The cables shall be supplied and delivered at site in original cable drums with manufacturer's name, cable size, type and length all clearly indicated on each drum.

4.6 The unit rate shall include loading, unloading, transport, storage, handling, unwinding the cable from cable drums and laying in the cable trench or erected on cable trays etc.

4.7 The cables shall be laid by skilled and experienced labour.

4.8 Where the cable route intersects roads, streets or pathways, RCC spun pipes shall be laid in the trenches to serve as cable ducts. The pipes shall be joined by RCC spun collars. The RCC pipes shall project at least 150 mm on either side of road crossing.

4.9 The cable loops shall be kept at both ends of the cable length. Minimum 3 meters long loop shall be provided.

4.10 The contractor shall take care to see that the cables received at site are apportioned to various locations to ensure maximum utilization and cable joints are avoided. This apportioning shall be got approved before the cables are cut to lengths. Straight joints are permitted only under exceptional circumstances.

5 Storage and loading, unloading of cables. :

5.1 Cable drums shall not be stored one above the other. Sufficient space between cable drums shall be left for air circulation and the drums shall stand on battens placed directly under the flanges.

5.2 Cable drums shall be stored preferably on a plain ground without having any hard stones or any other sharp materials projecting above the ground surface. The drums shall be stored preferably in the shed or otherwise they shall be covered by tarpaulin.

5.3 Drums shall be stored and kept in such a way that bottom cable end does not get damaged.

5.4 Drums shall be rotated only in the direction marked on the drum.

5.5 Loading and unloading shall be done with material handling equipments only.

6 Erection and laying of cables:

6.1 General:

6.1.1 All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of service.

6.1.2 When cables pass through holes in metal work, precautions shall be taken to prevent abrasion of the cables on any sharp edge. Cables passing through walls, ceiling or floor shall run through sleeves of Hume pipes of adequate dia. & after pulling of the cables both ends of the sleeve shall be sealed with fire resistance material to prevent spread of fire.

6.1.3 In every vertical channel, duct, trucking or cable trench, containing cables and exceeding three meters in length, internal barriers shall be provided so as to avoid heating of the air at the top of the unit.

6.1.4 In every vertical cable shaft, cable trench or any passage of cable through wall, ceiling, floor etc. Barriers against spread of fire and smoke shall be provided.

6.1.5 In fire hazard areas extra care shall be taken to prevent spreading of fire in case of cable failure. Cables in these areas shall be covered by glass wool or embedded in sand in appropriate trenches. The cabling in such areas shall be done as per FIA approval and IEE regulations.

6.1.6 Communication cables should be laid away from the power cables to avoid electromagnetic interference. Minimum clearance of 300 mm shall be maintained.

6.1.7 Control and power cables shall be laid on separate trays.

6.1.8 The maximum number of power cables on a tray should be limited to six.

6.1.9 Every cable shall be installed where it will not be exposed to direct sunlight, rain, dripping water, oil or any corrosive substance.

6.1.10 The cables shall be erected and laid by either of the following methods and as specified in Bill of Quantities or specifications or drawings.

6.2 Cables laid in excavated trenches:

6.2.1 The cables for external electrification work shall be laid in specially prepared cable trenches as specified under the section for cable trenches.

6.2.2 While laying cable in the trench the cable end shall be pulled with pulling eye only after mounting the drum on the jacks.

6.2.3 Care shall be taken in laying cables to avoid forming kinks. The drums shall be unrolled and cables run over wooden rollers, placed at intervals not exceeding 2 Mts.

6.2.4 High voltage cables are to be laid separately from other cables. HV, MV cables shall not be laid in the same trench and /or alongside of water main.

6.2.5 The cables shall not be laid directly in such soil, which is corrosive, and having components, which react with the insulating layer or amour of the cable. In such case it should be laid in pipes or concrete trenches.

6.3 Cables laid in built-up trenches:

6.3.1 For the cable route passing through the area which is proposed to be covered with concrete/tiles etc. the cables shall be laid in the R.C.C./brick masonry cable trenches as specified in the items. This arrangement shall be generally inside the building.

6.3.2 For the area outside the building but covered with concrete /tiles etc. the cables shall be laid through R.C.C. pipes laid in ground with brick chambers at both ends. The chambers shall be covered with C.I. heavy-duty covers if the area is prone for vehicular traffic otherwise medium duty C.I. covers should be provided.

6.3.3 Cables laid in the built-up cable trenches within the building shall be raised so as not to lay at the trench bottom. Cables shall be either secured to the wall by saddles or laid on hot dip galvanized angle iron brackets or cable trays, ladder, rack, trough etc.

6.3.4 Where cables are clamped to the wall a minimum clearance of 100 mm shall be maintained between wall and cable and minimum 150 mm vertical clearance shall be maintained between two cables. Where cables are laid on cable brackets, the brackets shall not be fixed more than

500 mm apart to avoid sag in the cables. Where cables are laid on cable tray /ladder /troughs /racks, minimum 300 mm distance shall be observed between adjacent tier of tray/ladder /troughs /racks, and cable shall be fixed minimum 25 mm away from wall and minimum 150 mm distance shall be observed between two adjacent cables. Cable shall be properly fixed with the tray /ladder /troughs /racks with cable tie or saddles.

6.3.5 The dimensions of the trenches shall be determined depending upon the maximum number of cables that is expected to be accommodated. Wherever specified, trenches shall be filled with fine sand and covered with RCC or steel chequered trench covers.

6.3.6 Where cables are to be installed under floors or above suspended ceilings or below ceiling, they shall be laid on a cable tray and shall be run in such positions that they are not liable to be damaged by contact with the floor or the ceiling or their fixture. The cable tray shall be properly fixed with tie rod to the ceiling. The concrete inserts for fixing the tie rod shall be put in place while casting the slab. The cable tray route shall be co-coordinated with other services. While laying the cables on the tray minimum 150 mm distance shall be observed between two adjacent cables. At least 25 % space shall be kept spare for any future installation.

6.3.7 The cable reaching for the motors in the mechanical room or plant room or machine room or service area shall be laid on cable tray. The cable reaching to motors shall be protected by rigid galvanized conduits up to a height of 300 mm above the floor. Above that height, the cable shall be protected by means of oil tight flexible metallic conduits fixed to the terminal box of the motor. The connection between the rigid conduit and the flexible conduit shall be done by a screwed coupling of an approved type. The flexible conduit shall be properly fixed with the terminal box of the motor by means of double hexagonal check nut.

6.4 Duct System:

Wherever specified cables shall be laid in underground ducts. The duct system shall consist of a required number of reinforced Hume pipes with simplex joints. Wherever asbestos cement pipes are used, the pipes shall be encased in concrete of 75 mm thick. The ducts shall be properly anchored to prevent any movement. The top surface of the cable ducts shall not be less than 60 cm below the ground level. The duct shall be at a gradient of at least 1:300.

The ducts shall be provided with inspection manholes at all direction changes and at required regular intervals for drawing the cables. The manholes shall be of reinforced concrete either cast-in-situ or precast. The manhole covers shall be cast iron and machine finished to ensure a perfect joint. The manhole covers shall be installed flush with the ground or paved surface. The ducts shall be properly plugged at the ends to prevent entry of water, rodents etc. Suitable duct markers shall be placed along the run of the cable ducts. The duct markers shall at least be 15 cm square

embedded in concrete, indicating the voltage, number of ducts and the direction of run of the cable duct. Suitable cable supports made of angle iron shall be provided in the manholes for supporting the cables. Proper identification tags shall be provided for each cable in the manholes.

6.5 Cables on Trays / Racks:

6.5.1 Cable shall be laid on cable trays/racks wherever specified. Cable racks/trays shall be of ladder, trough or channel design suitable for the purpose. The nominal depth of the trays/racks shall be 150 mm. The width of the trays shall be as per the design shown on drawing.

The cable trays shall be made of steel or Aluminum as specified. The trays/racks shall be completed with end plates, tees, elbows, risers, and all necessary hardware. Steel trays shall be hot dip galvanized. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles made of Aluminum strips with PVC covering shall be used for securing the cables to the cable trays. The cable trays shall comply with the following requirements.

a. The tray shall have suitable strength and rigidity to provide adequate support for all contained cables.
b. It shall not present sharp edges, burrs or projections injurious to the insulation of the wiring/cables.
c. If made of metal, it shall be adequately protected against corrosion or shall be made of corrosion resistant material.
d. It shall have side rails or equivalent structural members.
e. It shall include fittings or other suitable means for changes in direction and elevation of runs.

6.5.2 Installation of cable trays/racks:

a. Cable trays shall be installed as a complete system. Trays shall be supported properly from the building structure. The entire cable tray system shall be rigid.
b. Each run of the cable tray shall be completed before the installation of cables.
c. In portions where additional protection is required, non-combustible enclosures to be used.
d. Cable trays shall be exposed and accessible.
e. Where cables of different system are installed on the same cable tray, non-combustible, solid barriers shall be used for segregating the cables.
f. Cable trays shall be grounded by two nos. earth continuity wires. Cable trays shall not be used as equipment grounding conductors.

7 Cable trenches (excavated):

7.1 The cable trenches shall be excavated 60 cms below the finished ground level and shall have a minimum width of 300 mm for laying of single cable. When more than one cable are laid in the

same trench, the width of the trench shall be increased such that the spacing between the cables is 200 mm and the end cables are at minimum 100 mm from the side of the trench. At the turning of the cable route the trench shall be dug with radius equal to 15 times the cable diameter.

7.2 The trenches shall be cut square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed and leveled. The bottom of the cable trench shall be prepared with 100 mm sand bed for laying the cables.

7.3 The cables shall be laid in trenches over the rollers. After the cable is laid and straightened it shall be covered with sand, and bricks shall be placed on top and at the side of the cable.

7.4 Wherever specified, half round RCC pipes shall be placed above the cables.

7.5 The cable trench then shall be refilled with excavated materials after removing the stones and other sharp materials and the refilled materials shall be compacted with light ramming.

7.6 Approved Cable markers made of Aluminum or CI with 15 cms crown shall be provided along the route of cables at a spacing of 25 - 30 meters and also at both ends of crossings or at the cable turning point. The class, type, No. of cables shall be indicated on markers.

7.7 Cable shall be laid in Hume pipes at all road crossings and in GI pipes at the wall entries or at the crossing of the drains/gutters.

8. Cable jointing:

8.1 The straight joint in cable shall be avoided as far as possible by correctly apportioning the cable lengths. If unavoidable following precautions shall be taken while jointing.

8.2 Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointer. The location of the cable joint shall not be where the cable takes a bend also where the soil is loose and shows signs of subsidence.

8.3 Cable jointing boxes shall be of appropriate size suitable for PVC insulated cables of particular voltage ratings and shall be of approved make.

8.4 Jointing of cables in the joint boxes and the filling of the compound shall be done in accordance with the manufacturer instructions and in an approved manner. All straight or T joints shall be done in epoxy mould boxes. All terminal leads of conductors shall be heavily soldered up to at least 50 mm length.

8.5 All cables shall be joined colour-to-colour and tested for insulation resistance and continuity before commencing the jointing. The seals of cables shall not be removed until preparations for jointing are completed. Joints shall be finished on the same day, as commenced and sufficient protection from the weather shall be arranged.

8.6 Joints shall be made by means of suitable solder for conductor, the conductors being firmly bolted into the connections or ferrule and the whole end soldered with proper solder and flux or resin. Conductors shall be properly insulated with high voltage insulating tape and by using separators of approved size and pattern. The joints shall be completely filled with epoxy compound (with necessary tapping) to ensure proper filling of the box.

8.7 Epoxy compound shall be prepared as per manufacturer instructions. Oil, water or any other liquid shall not be added to the mixture and which shall be used within 30 minutes of mixing. The surface on which epoxy is to be used shall be free from dust, rust, oil, grease and shall be dry. Joint shall not be moved or disturbed until the epoxy has completely hardened.

9 Cable Termination. :

9.1 All cable terminations for conductors' upto 4 sq.mm may be insertion type and all higher sizes shall have tinned copper compression lugs.

9.2 Cable termination shall be done in cable end box or in terminal box or in pillars etc. The end terminations shall be insulated with a minimum of six half lapped layers of PVC tape.

9.3 Cable terminations are to be made with flange type brass cable glands so as to grip inner and outer PVC sheaths and also the cable amour. Cable gland shall be bonded to earth.

9.4 The cable conductor ends are to be connected by crimping tinned heavy-duty copper lugs. Hydraulic crimping tool shall be used.

9.5 Every connection at a cable termination shall be mechanically and electrically sound and protected against mechanical damage and any vibration liable to occur shall not impose any harmful mechanical damage to the cable conductor.

10 Testing of cable before laying and commissioning:

All tests shall be carried out in accordance with relevant IS codes of practice, IE rules and specifications.

10.1 100% cable drums shall be checked for continuity and cross continuity tests to ensure that there is no internal damage to the cable during transportation.

10.2 Prior to burying of cables, insulation resistance shall be measured with 500 V megger between the cores and all the cores to earth (amour) and results shall be recorded.

10.3 On completion of cable laying work, all the tests such as insulation resistance test, continuity test, sheathing continuity test, earth test etc. shall be conducted in the presence of the Employer.

10.4 After the cables are installed, before commissioning it shall be tested for high DC voltage test. The recommended volts and duration of the test between each core and metallic amour (earth) at 3 KV DC is for 5 minutes. During high voltage test all electrical equipments related to the cable installation must be earthed and adequate clearance shall be maintained from the other equipments and from work to prevent flash over.

SECTION – II

Specifications for Earthing and Lightning Protection

1 Scope:

This specification covers supply of necessary materials, and erection at site, of complete earthling system including earth pits at the locations indicated, earth conductors from earth pit to the respective equipments, switchgears, pillars etc. and making connections, testing at site, commissioning and handing over.

2 Applicable standards:

The entire work of earthing system, shall confirm to IS 3043, Indian Electricity Act and Rules and relevant regulations. The work of Lightning protection shall conform to IS 2309.

3 General requirements:

3.1 The earthing shall generally be carried out in accordance with the requirements of Indian Electricity Rules 1956 as amended from time to time and relevant regulations. Following IE rules are particularly applicable. IE Rule Nos. 32, 51, 61, 62, 67, 69, 88(2) & 90.

3.2 All earth connections shall be carefully made, visible for inspection, and the testing of individual earth electrode shall be possible.

3.3 All materials, fittings etc. used in earthing shall conform to IS specifications and in the absence of which the approval of competent authority shall be obtained.

3.4 The earthing electrode shall be at a minimum distance of 2 metres away from the outer face of the building wall. A minimum clearance of twice the depth of the electrode shall be maintained between two earthing stations.

3.5 A brick masonry chamber to facilitate easy identification and for carrying out periodical tests and inspection shall be constructed on top of the earth pit.

3.6 All metal conduits, trunkings, cable sheaths, HT and MV switchgears, Transformers, distribution boards, meters, light fixtures, fans, and all other metal parts forming part of the work shall be bonded together and connected to earthing network as specified.

3.7 Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after passage of fault currents.

3.8 Joints shall be soldered, tinned and double riveted. All the joints shall be mechanically, electrically continuous and effective. Joints shall be provided against corrosion.

4 Earth Electrodes:

4.1 The materials of earth electrode and earth conductors shall be galvanised iron unless specified otherwise in Bill of Quantities, specifications or drawings.

4.2 The earth electrodes shall be free from paint, enamel, grease etc.

4.3 The earth electrode shall be embedded as far as practicable in a moist soil and below permanent moist level.

4.4 The earth electrode shall not be installed in the proximity of a metal fence.

5 Types of earth electrodes:

The earth electrodes shall be either a pipe electrode or plate electrode, the details of which are as given in the following sections of specifications, drawings and BOQ.

6 Pipe electrode:

6.1 Pipe electrode shall consist of 2.5 meter long single piece G.I. pipe of min. 40 mm dia. as specified and shall be cut tapered at the bottom. 12 mm dia. holes shall be drilled with 75 mm spacing between the holes and in a staggered manner as indicated in IS 3043.

6.2 The electrode shall be buried vertically in a specially prepared earth pit of size 35 cm x 35 cm and the earth pit shall be filled with alternate layers of charcoal, salt and fine washed sand for a minimum thickness of 150 mm. A funnel with wire mesh inside shall be fixed to the top of the GI pipe for watering purpose.

6.3 The earth conductor of 25 x 3 mm GI strip shall be connected to the electrode just below the funnel with proper terminal lugs and check nuts and the other end of earth conductor shall be connected to the equipotential bus of the equipments.

6.4 A masonry chamber with a cast iron cover hinged to the cast iron frame embedded in the top portion of the masonry shall be constructed on top of the GI pipe to house the funnel and the earth connection. The approximate size of the chamber shall be 300 mm x 300 mm and 300 mm deep.

6.5. The earth conductor from electrode shall be taken out of the masonry chamber through a protecting pipe embedded in the masonry.

6.6 The top of the masonry chamber shall be 50 mm above the finished ground level.

7 Plate Electrode:

7.1 The plate electrode shall consist of either copper plate of size 60cm x 60 cm x 3.15 mm or GI plate of size 60 cm x 60 cm x 6.3 mm, and as specified in the BOQ or drawings.

7.2 The electrode shall be buried vertically in a specially prepared earth pit, which shall be dug up to required depth, from the ground level. The earth plate shall be placed in the earth pit with its face vertical and embedded in the alternate layers of coal and salt for a minimum thickness of 15 cms.

7.3 The earth conductor shall of same material as of the earth electrode. For copper earth electrode copper strips shall be provided as conductor and for GI earth electrode GI strips shall be used as earth conductor. The size and material of the earth conductor shall be as specified separately in the Bill of Quantities or drawings. The earth conductors shall be connected to the earth electrode (plate) with G.I. nut bolts, check nuts and washers and welded at the edges and shall be brought up in the masonry chamber at the ground level.

7.4 The earth conductor shall be extended via the earth link provided in the masonry chamber. This link shall be connected to earth conductors from the earth plate and earth conductor going to equipments with two Nos. of nut bolts, check nuts and washers (all of GI) to make secured connections. This link can be removed for testing the earthing.

7.5 A 20 mm dia. G.I. pipe shall be provided from the masonry chamber to the top of the earth plate for watering purpose. The G.I. pipe shall be provided with a funnel at the top with wire mesh inside.

7.6 A masonry chamber with a cast iron cover hinged to the cast iron frame embedded in the top portion of masonry shall be constructed on top of GI pipe to house the funnel & the earth connection. The approx. size of the chamber shall be 300mmx300mmx300mm deep.

7.7 The earth conductor from electrode shall be taken out of the masonry chamber through a protecting pipe embedded in the masonry.

7.8 The top of the masonry chamber shall be 50 mm above the finished ground level.

8 Earth conductor:

All earthing conductors shall be of high conductivity copper and or GI as specified and shall be protected against mechanical injury or corrosion. The connection of earth continuity conductors of earth bus and earth electrodes shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cable trays or conduits and cables by using suitable clamps made of non ferrous metals.

8.1 The cross-sectional area of earthing conductor shall not be smaller than half that of the largest current carrying conductor, subject to the minimum size being not less than 1.5 sq.mm for copper and 2.5 sq.mm for Aluminium conductors and the upper limit being 70 sq.mm for copper and 120 sq.mm for Aluminium. The size of the galvanised iron earth continuity conductors may be equal to the size of the current carrying conductors with which they are to be used.

8.2 As a guideline the following sizes of earth continuity conductors shall be used for earthing installation

8.2.1 Size of earth conductors for lighting and power circuits.

Cross sectional area of current carrying Cu conductor	cross sectional area of earth continuity Cu conductor
Size in sq.mm	Size in Sq.mm
1.5	1.5
2.5	1.5
4.0	2.5
6.0	4.0

8.2.2 Size of earth conductors from main switchboard to sub main switches or distribution boards.

Cross sectional area of current carrying conductor Copper/Alum.	Cross sectional area of earth continuity conductor Copper/Alum.
Size in sq.mm	Size in sq.mm
4	2.5
6	4
10	6
16	10
25	16
35	16
50	25
70	35

95	50
120	70

8.2.2 The size of an earth continuity conductor contained in a flexible cable or flexible cord shall be equal to that of the current carrying conductor.

9 Earth connection:

9.1 All metal clad switches and other equipment carrying single-phase current shall be connected to earth by a single connection. All metal clad switches carrying three-phase medium voltage and high voltage shall be connected with earth by two separate and distinct connections.

9.2 The earthing conductors inside the building, wherever exposed shall be properly protected from mechanical injury by running the same in G.I. pipe of adequate size. Earthing conductors outside the building shall be laid 600 mm below the finished ground level.

9.3 The over lapping of strips at joints where required shall be minimum 75 mm. The joints shall be revetted in an approved manner. Lugs of adequate capacity and size shall be used for all termination of wires above 6 sq.mm size and bare copper wire above 2.5 mm dia. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance and properly tinned.

10 Connection of earthing conductor:

The earthing conductors are broadly divided in the following categories:

10.1 Main earthing conductor shall be taken from the earth electrode to the earth bus/connection at the main switchboard.

10.2 Sub-main earthing conductor shall run from the main switchboard to the sub-distribution boards.

10.3 Final earthing conductor shall run from the sub distribution boards to the final distribution boards.

10.4 Circuit earthing conductor shall run from the final distribution board to the exposed metal of the equipment to be earthed. This may run directly from final distribution boards or through earth leakage circuit breaker.

10.5 Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switch boards at which they originate or at the commencement of the run by an earthing conductor.

10.6 Earthing conductor enclosed with the current carrying conductors within the flexible cord shall be used only in case of equipments connected by flexible cord.

10.7 Lighting fittings, switches and accessories shall also be provided with an earthing conductor even though they may be rigidly secured / fixed with metallic conduit.

10.8 The electrical resistance of earthing conductors shall be low enough to permit passage of fault current necessary to operate a fuse, protective device or a circuit breaker.

11 Prohibited Connection:

Use of following as earth conductor is not recommended, and strictly prohibited for earthing an installation or even as a link in an earthing system. Neutral conductor, sprinkler pipes or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures or amour of cables and conductors, metallic conduits and lightning protection system conductors are all prohibited to be used as earth conductor.

12 Earth Resistance:

The earth resistivity of the soil where the earthing stations are located shall be submitted to the Architect before the earthing work starts and the approval shall be taken. If the earth resistance is too high and multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

13 Testing:

On completion of the entire installation, the earthing network shall be tested for their resistance to earth in accordance with IS 3043. The contractor shall provide all meters, instruments & labour required for the test. The test results shall be submitted in triplicate to the Employer for approval. The following tests shall be conducted.

a. Earth resistance of electrodes
b. Impedance of earth continuity conductors.
c. Effectiveness of earthing.

14 Lightning Protection:

Lightning protection network shall be provided for the specified buildings and locations for protection against lightning strikes. The network shall essentially consist of Air-termination units, down conductors, roof conductors, test terminals and earth electrodes etc. The entire system shall conform to IS requirements.

14.1 Air-terminations:

a) An air-termination shall consist of a 1200 mm long, 25 mm dia 14 SWG Cu tube with 100 mm dia Cu sphere fixed at the top of the tube. The Cu sphere shall be fixed with 5 nos. 125 mm long and 12.5 mm dia threaded Cu spikes.

b) The complete assembly shall be fixed at a highest possible location and shall project at least 1500 mm above the network on which it is fixed.

c) All air termination shall be effectively secured against overturning by means of rod brackets and additional supports as required, which shall be permanently and rightly attached to the building. The method and nature of fixing should be simple, solid and permanent.

14.2 Down Conductors and Roof Conductors:

a) GI strip of specified size shall be used as down / roof conductors and the conductors shall be without sharp bends, upturns and kinks.

b) As far as possible, the joints shall be avoided in down/roof conductors. In down conductor below ground level there shall be no joint. However in a total system where joints are unavoidable, the jointing shall be with approved method only. The joints shall be mechanically and electrically effective. The joints may be clamped, screwed, bolted, but preferably welded. The length of overlap at the joints shall not be less than 200 mm. Contact surface at joint shall be cleaned and then inhibited from oxidation with suitable non corrosive compound.

c) The conductors shall be adequately protected against mechanical damage but for which metal pipes shall not be used.

14.3 Test Links and Testing:

Each down conductor will be provided with a testing point in a position convenient for testing but inaccessible for interference. No connection other than one direct to an earth electrode shall be made below a testing point. Testing points shall be with Copper. The ohmic resistance of the lightning protective system with air termination but without earth connection shall be measured and should be a fraction of an ohm. Earth resistance shall be measured in accordance with IS: 3043.

14.4 Earth Terminations and Electrodes:

Each down conductor shall have an independent earth termination. It should be capable of isolation for testing purposes. Earth electrodes shall be constructed and installed in accordance with IS: 3043.

SECTION – III

Specifications for MCB DB, MCB and RCCB

1 Miniature Circuit Breaker Distribution boards:

1.1 Miniature circuit breaker distribution boards shall conform to IS 2675, IS 8623 and shall be suitable for operation on three phase, 4 wire, 415 V, 50 Hz, AC supply or single phase, 2 wire, 230 V, 50 Hz, AC supply.

1.2 The MCB distribution board shall be in sheet steel enclosures with removable type cover with additional door for protecting accidental operation.

1.3 Enclosure and door shall be made out of 16 SWG CRCA sheet steel and powder coated and of approved shade. The interior shall be off white finish. The DB shall be totally enclosed with dust and vermin proof construction and shall be of double door type. The DB boxes shall be as supplied by the original manufacturer.

1.4 Where distribution boards are specified to be complete with an isolator as incomer, the isolator shall be double pole for SP and N distribution boards and 4 pole for TP and N distribution boards.

1.5 Where distribution boards are specified to be complete with MCB + ELCB as incomer, the MCB + ELCB shall be double pole for SP and N distribution boards and 4 pole for TP and N distribution boards.

1.6 Bus bars shall be tinned copper. The internal connections in the DB shall be by using stranded copper conductor, PVC insulated wire with copper lugs crimped at both ends. Neutral busbar and earth busbars shall also be provided in the enclosure. Neutral busbar shall have equal rating of phase busbars.

1.7 Distribution boards shall be provided with circuit identification by means of directory on the front cover. Upon completion of the works, the contractor shall provide and fix accurate framed circuit lists for all distribution boards. These shall consist of perspex envelopes, fixed securely by an approved method on the inside face of each distribution board front cover into which shall be inserted a neatly typed list of circuits, indicating the number of circuits, phase, cable, size, number of points connected, circuit rating and the loading. The contractor, shall also provide and fix by means of brass screws tapped into the D.B. cover, labels, with black letter on a white background for all distribution boards, MCB + ELCB, Isolators etc. The engraving on the labels and the inscription on the circuit lists shall be approved by the Employer before the work is carried out.

1.8 All incoming terminals shall be fully shrouded.

1.9 The conduit entry plates shall be removable type and shall be provided at top and bottom. All the conduits shall be properly terminated using glands, grips, checknuts, female adapters with bush etc.

1.10 Wiring shall be terminated properly using crimping type copper lugs/sockets. Identification ferrules shall be provided on all wires. Each circuit shall have an independent neutral.

1.11 Two No. Earth terminals shall be provided on each Distribution Board.

1.12 Distribution boards shall be installed surface mounted or recessed mounted as specified and erected at the locations shown.

Surface mounted DB shall be mounted on a suitable size frame made out of GI ZED section. The hole fasts of the frame shall be grouted in the wall with cement mortar and the frame shall be

painted with two coats of red oxide and two coats of enamel paint of approved shade. The DB shall be mounted on this frame with proper size nut bolts.

Recessed mounted DB shall be erected in the chase/cut portion of the wall. The cutting of the walls shall be done while constructing the wall and shall be of adequate size to comfortably accommodate the DB. The cut portion shall be smoothened and made plain and shall be fine finished. The DB shall be fixed in this chased portion with suitable clamps and bolts. The top cover of the DB cabinet shall be projecting out of the wall surface and free from any obstruction so as to open the same smoothly.

2 Miniature Circuit Breakers:

2.1 MCB's shall be manufactured in accordance with IS 8828 having a short circuit breaking capacity category 10 kA at both 240 volts 50 Hz. and 240/415 V, 50 Hz and complying with the test requirements for both reference calibration temperatures of 20 degree C and 40 degree C.

2.2 All miniature circuit breakers shall be rated to withstand the fault currents of the circuits they protect without causing any interference in any other protective device associated with the distribution system. At the same time the design of the circuit breakers shall be such that, it will protect the circuit for which it is intended and not cause or allow other protective devices to operate when fault conditions apply.

2.3 Miniature circuit breakers shall be capable of carrying its full rated current continuously without tripping out.

2.4 All the miniature circuit breakers shall be fitted with a magnetic undelayed tripping mechanism. These shall have overload and short circuit elements.

2.5 Time current characteristic of the MCB shall match with that of HRC fuses..

3 Residual current operated circuit breakers (RCCB)

3.1 RCCB’s shall be manufactured in accordance with IS 12640 and IS 8828 having a short circuit breaking and earth fault protection up to 9 KA at both 240 Volts 50 Hz and 240/415 V, 50 Hz and complying with the test requirements as per IS 2640.

3.2 RCCB shall be designed to interrupt the circuit during an earth fault, overload or short circuit. All RCCB shall be high sensitive and calibrated to trip the power supply when the residual current is more than 50 % of its calibrated rating. This means that a 30 mA sensitivity RCCB should trip when the residual current is in the range of 15 to 30 mA and a 300 mA RCCB should trip when the residual current is in the range of 150 to 300 mA.

3.3 The RCCB’s shall be truly current operated, which means that it shall be totally independent of the main voltage for tripping. RCCB must operate for nominal voltage well below the maximum safe value of 10 volts. RCCB shall interrupt the circuit within 30 milisec at a leakage current of 30 mA.

3.4 RCCB shall be provided with a neutral advance mechanism. RCCB shall be functioning even in the event of failure of neutral and/or any one or two of phase supply conductor. RCCB shall be provided with trip free mechanism ensuring that the device cannot be reclosed / reset if the fault persists. RCCB shall be functioning even in the case of interchange of load and supply side connections.

3.5 Test button shall be provided to check he correct operation of the unit.

3.6 RCCB shall be designed for a very long life of a minimum of 20,000 operations and shall be capable of withstanding inrush current of 4 to 8 times the rated current. For the proper functioning the RCCB should not require any connection of earthing on the device.

3.7 The device should have high tripping accuracy of less than 5% of rated tripping current. The RCCB shall be provided with clear indication to show whether the tripping is due to current leakage or overload/short circuit.

3.8 The MCB section of RCCB shall be provided with arc chambers and vents are also to be provided to release the arcing products in the atmosphere, so as to increase contact lift and to prevent damage to the insulation. The self-extinguishing thermoset plastic material shall be used for body and shall have a modular construction. The device should be vibration proof.

4 Moulded Case Circuit Breakers (MCCB)

MCCB's used shall be suitable for 440 V, AC, 50 Hz supply and shall be capable of withstanding electrical and mechanical stress due to short circuit capacity as specified for individual requirement. The MCCB shall be compact in size, dust and vermin proof with quick make and break operating mechanism. The construction shall be such as to ensure maintenance and current setting adjustment without removing the MCCB from the panel. The MCCB shall be suitable for interlock with panel door on which it is mounted.

SECTION - IV

Specifications for Medium Voltage Distribution Panel Boards

1 Scope:

This section shall cover supply, assembly, installation, connection, testing and commissioning of medium voltage distribution panel boards as described in this specifications, drawings and schedule of quantities.

2 System:

All the medium voltage distribution panel boards shall be suitable for operation on three phase, 4 wire or single phase, 2 wire with normal system voltage of 415/240 volts, 50 Hz, A.C. supply with solidly grounded neutral system.

3 Weather condition at site:

The panel boards shall be suitable for continuous operation and designed to withstand heaviest conditions at site.

a) Temperature range: 40 to 45 ^{0} C

b) Relative humidity: 50 to 80 %

c) Weather: Dusty

4 Applicable IS Standards:

The panel boards to be supplied under this specification shall confirm to latest editions of relevant Indian Standards and Indian Electricity rules and regulations. The following Indian Standards shall be complied with.

IS 4237: General requirements for switch gear and control gear for voltage not exceeding 1000 V.

IS 2208: HRC cartridge fuse links upto 610 V.

IS 2705: Current transformers

IS 1248: Electrical Indicating Instruments.

IS 375: Switch gear bus-bars, main connection and auxiliary wiring, marking and arrangement for.

IS 2147: Degree of protection provided by enclosures for low voltage switchgear and control gear.

IS 2675: Enclosed distribution fuse boards and cutouts.

IS 2557: Danger notice plates.

IS 1567/4047: Specifications for switch fuse units.

IS 3072 (I): Installation and maintenance of switchgears.

TECHNICAL CONDITIONS ELECTRICAL

5 General:

5.1 **Shop drawing:**

Prior to fabrication of the panel boards, the contractor shall submit for the approval of the Employer, the shop / vendor drawing and design calculations indicating type, size, short circuit rating of all the electrical components used, busbar size, internal wiring size, panel board dimension, colour, mounting detail etc. The contractor shall submit manufacturer's catalogues of the electrical components installed in the panel boards.

5.2 **Inspection:**

At all reasonable times during production and prior to transport of the panel boards to site, the contractor shall arrange and provide all the facilities at manufacturer's plant for inspection and testing and any stage inspection agreed upon.

5.3 **Test certificates:**

Testing of panel boards shall be carried out at factory or at site as specified in Indian Standards in the presence of Employer. The test results shall be recorded on prescribed forms. The test certificates for the test carried out at factory or at site shall be submitted in duplicate to the Employer for approval.

6 Cubical type Panel boards:

6.1 Construction:

6.1.1 Structure

The panel board shall be metal enclosed sheet cubical, compartmentalised suitable for indoor or outdoor installation having dead front, floor mounting type. All M.S. sheets used in the construction of panel boards shall be 16 SWG (1.6 mm) thick unless specified otherwise in the item and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam welded, all welding slag ground off and welding pits wiped smooth with plumber metal.

The panel boards shall be totally enclosed, completely dust and vermin proof. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be lockable and fully gasketed with foam rubber or neoprene rubber strips. All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with bolt and nuts. Self-threading screws shall not be used in the construction of panel boards. Suitable base channels (min size 75 mm x 75 mm x 5 mm thick) shall be provided at the bottom. A Clearance of 300 mm between the floor of the panel board and the bottom of the lower most units shall be provision Panel boards, if necessary shall be preferably arranged in multitier formation. The panel boards shall be of adequate size with a provision of spare space (as jointly decided with the Employer to accommodate possible future additional switchgear. The size of the panel boards shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component does not attain temperature more than 40 degree Celsius. Opening for natural ventilation shall be provided and shall have screens or grills made of brass or stainless steel wire mesh.

The panel boards shall be provided with removable sheet steel plates at top and bottom with knockout holes of appropriate size and number in conformity with the number, and size of incoming and outgoing conduits /cables.

The panel boards shall be designed to ensure maximum safety during operation, inspection, connection of cables, maintenance and repairs etc. with busbar system energised. Means shall be provided to prevent shorting of power and /or control terminals due to accidental drop of maintenance tools etc. inside the panel board. Partitions between feeder compartments, busbar

chamber, cable alleys, vertical panels etc. shall be provided to take care of this aspect. The panel boards shall be sufficiently rigid to support the equipment without distortion under normal and short circuit condition; they shall be suitably braced for short circuit duty.

For buses and cables, access shall be limited from front and top only. All other equipment shall be mounted on the front side, (unless specified otherwise for any specific panel) and shall be accessible from the front. All joints and connections shall be made by cadmium plated high tensile steel bolts, nuts and washers secured against loosening.

It shall be possible to insert any new cable and to connect all load side wiring with the busbar energized, without any special precautions. Opening of the busbar chamber shall be possible with special tools only.

6.1.2 **Protection clause:**

All the outdoor panel boards shall have protection clause of IP 55. The complete board shall be double jacketed with insulation material to withstand outdoor temperature. All the indoor panel boards shall have protection clause IP 52.

6.1.3 **Powder coating**:

All sheet steel work shall undergo a seven tank process of degreasing pickling in acid, cold rinsing, phosphatising, passivating and then treated with powder coating treatment. The finishing shall be of shade as approved by the Employer. The interior surface shall have similar finish.

6.1.4 **Circuit compartments:**

Each switch fuse units and meters shall be housed in a separate compartment and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly inter locked with the breaker/switch fuse units in "ON" and "OFF" position. However it shall be possible to bypass this interlock for inspection purpose.

6.1.5 **Instrument compartment:**

Separate and adequate compartment shall be provided for accommodating instruments, indicating lamps, control contactors /relays, and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker/switch fuse units busbar and connections.

6.1.6 **Busbars and wiring**:

The busbars shall be of three-phase four wire system with separate neutral and earth bar. The busbar and interconnection between busbars and various components shall be with high conductivity, hard drawn, electrolytic copper strips.

The busbar shall be of rectangular cross section designed to withstand full load current for phase busbars and full rated current for neutral busbars and shall be extensible on either side. The busbar shall have uniform cross-section through out the length. The rating of the busbars shall be as specified in BOQ and/or drawings.

The busbars and interconnections shall be insulated with color coded insulation tapes/covers. The busbars shall be supported on unbreakable, non-hygroscopic insulated supports at sufficiently close intervals to prevent sagging and shall effectively withstand electromagnetic stresses in the event of short circuit. The busbars shall be housed in a separate compartment. The busbar shall be isolated with 3 mm thick hylum sheet to avoid any accidental contact. All busbars connection shall be done by drilling holes in busbars & connecting by chromium plated brass bolt and nuts. Additional cross section of bus bars shall be provided in all distribution boards to cover up the holes drilled in the busbars. Spring and flat washers shall be used for tightening the bolts. All interconnections between busbars and circuit breakers/switches and between circuit breakers/switches and cable terminals shall be through solid copper strips of proper size to carry full rated current. These strips shall be insulated with insulating tapes/covers.

All interconnections in the panel shall be with Cu busbars for switchgears of ratings 63 A and above. For switch gears below 63 A, flameproof Cu wires to be used with lugs crimped at both ends.

All busbars shall be tinned copper strips of the given cross section. Unless otherwise specified all bus bars are to be designed taking maximum current density of 800 Amp per sq inch.

All busbars are to be covered with heat shrinkable PVC sleeves of red, yellow, blue and black colours to indicate various phases and neutral bar clearly.

6.1.7 Terminals:

The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments metering shall be mounted on the terminal blocks. No direct connection of incoming or outgoing cables to internal components of the panel board is permitted. Only one conductor may be connected in one terminal. Adequate no of spare terminals of required size shall be left in each compartment.

6.1.8 Wire ways:

A horizontal wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

6.1.9 Cable compartments:

Cable compartments of adequate size shall be provided for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate proper supports shall be provided in the cable compartments to support cables. All outgoing and incoming feeder terminals shall be brought out to terminal blocks in the cable compartment.

6.1.10 Earthing:

Tinned copper earth bars of suitable size shall be provided for the entire length of the panel. Provision shall be made for connection from this horizontal earth bar to the earth pit on both side of panel board. The earth continuity conductor of each incoming and outgoing feeder shall be connected to the vertical earth bar.

All non-current carrying parts and the framework of panel board shall be connected to this earth bar. All doors and movable parts shall be connected to earth bus with flexible copper connections. Armour of the cable shall be properly connected with earthing clamp, and the clamp shall be bonded with the earth bar.

6.1.11 Name plate, labels and directory:

A nameplate with switchgear designation shall be fixed at the top of the panel board. A separate nameplate giving feeder details shall be provided for each panel.

Engraved nameplates shall be of 3-ply (red-white-red or black-white-black) lamicoid sheets. Size of the letters shall be 5 mm. Nameplates shall be fastened by screws and not by adhesive. Size of letter for Main nameplate shall not be less than 20 mm.

Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the panel board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet. PVC labels shall be provided for spare circuits also.

Panel boards shall be provided with a directory indicating the area or loads served by each circuit breaker, the rating of breakers, size of conductors, etc. The directory shall be mounted in metal holder with a clear plastic sheet on inside surface of the front door.

6.1.12 Danger notice plates:

Danger notice plates with symbol as per IS shall be provided on panel boards.

6.1.13 Fuse puller etc:

One set of fuse puller (for various amps of fuses), panel keys and special tools etc. shall be supplied with each panel board.

6.1.14 Internal components:

The panel boards shall be equipped complete with all type of required number of circuit breakers, switch fuse units, contactors, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbars, cable boxes, cable glands etc., and all the necessary internal connections/wiring as required and as indicated on relevant drawings.

Components necessary for proper complete functioning of the panel boards, but not indicated on the drawings and specifications shall be supplied and installed.

All part of the panel board carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at any part of the panel boards.

The derating of the different items resulting from the prevailing conditions like room temperature shall be allowed for while selecting the components.

All units of the same rating and specifications shall be fully interchangeable.

1. Switches:

Switches shall be air break type as per IS 4047. The switch operating handle shall be front mounted and interlocked with the door when the switch is in ON position. The live parts shall be shrouded with suitable insulating barrier so as to prevent accidental contact with the live parts after opening the cubicle front door.

2. Fuses:

All power and control fuses shall be link type. Screw type fuses are not acceptable. All fuse links shall be HRC type and shall generally conform to IS 2208. Rewirable fuses are not acceptable. All fuses shall be readily accessible for replacement. It shall not be necessary to remove any piece of equipment or to disconnect wiring before replacing fuses using fuse puller.

3. Control switches:

Ammeter selector switches shall have make before break feature on its contacts. The selector switches shall generally have four positions for reading three phase currents and neutral. The voltmeter selector switch shall also have four positions and the fourth shall be OFF position. Remote trip /off selector switch shall be lockable in OFF position.

4. Indicating lamps:

The indicating lamps shall be LED type.

5. Measuring and Indicating instruments:

All measuring and indicating instruments shall be Digital type, in square pattern moving from 90 deg. scale, 96mm x 96mm, flush mounting type. Instrument shall be of accuracy clause 1 as per

IS 1248. Ammeters for motor and other feeders shall be graduated for full load current of motor with a compressed scale at the end for at least 6 times full load current. The KW meter and PF meter shall be suitable to measure unbalanced loads on 3-phase 4 wire system. PF meter shall be in 0.5 - 1 - 0.5 range. CT's shall be resin cast, with class 1 accuracy and 15 VA burden. The energy meters shall be CT operated electrolytic type.

6. Push buttons:

Push buttons shall be suitable for panel mounting type and comprise of a contact element and an actuator. The contacts shall be of silver alloy and of 10 A continuous current rating. Each push button shall be provided with 1 NO + 1 NC contacts, but if required 2 NO + 2 NC contacts be provided. Colour of the knob shall be as per IS.

7. Packing and transport:

The bigger size panel boards shall be shipped to site in wooden crates. They shall be wrapped with polythene sheets before being placed in crates to prevent damage to the finish. Crates shall have skid bottoms for handling. All panels shall have one set of two silica gel bags, which shall be checked periodically both while in storage and while in service. The smaller size panel boards shall be transported to site with polythene sheets wrapped all along and wooden frame to cover the same.

8 Storage at site:

The panels shall be stored in a well ventilated, dry place and suitable polythene covers shall be provided for necessary protection against moisture.

9 Installation:

The panel boards shall be installed at the location as indicated in the drawings. The contractor shall submit for approval a shop drawing indicating room size, panel size and method of installation prior to installation.

The cubicle type panel board shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. Suitable MS base channel shall be embedded in foundation on which the panel can be directly installed. If the panel is provided with an angle iron pedestal or base plate the same shall be grouted firmly in the floor. The panel boards shall be properly aligned and erected in plumb and bolted to the foundation by bolt parallel to the walls.

After installation of the panel boards, various components of the boards shall be checked and be put in working order. The cables laid through cable trench or on cable trays/racks etc. shall be terminated on the bottom plate or top plate as the case may be, by using siemens type brass compression glands. The individual cables shall then be led through the panels to the required

feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switchboard earth bus shall be connected to the local earth grid. Connection of cables shall be by crimping type Cu lugs using hand operated or hydraulic crimping tool as per cable sizes.

10 **Testing:**

1) Testing at factory:

Panel boards shall be inspected at factory at pre-assembly stage and any modifications or changes as suggested shall be incorporated. The panel boards shall be again inspected and tested at the factory after assembly of all components and completion of all inter-connections and wiring. The tests shall include all routine and type tests as per relevant ISS.

2) **Testing and pre-commissioning checks at site:**

Panels shall be commissioned only after the successful completion of the following tests. The tests shall be carried out in the presence of the Employer.

2.1 Pre commissioning checks:

1) Check all panels are aligned in line and properly erected in plumb.
2) All withdrawals portions shall be capable of smooth extraction and isolation.
3) All main and auxiliary bus bar connections shall be checked and tightened.
4) All wiring terminations and bus bar joints shall be checked and tightened.
5) Wiring shall be checked to ensure that it is according to the drawing.
6) Before fitting the covers, all chambers, compartments, cable alleys etc. shall be checked for complete cleanliness and removal of foreign matter if any, particularly the tools used for erection, cut pieces of cable armour etc. Covers shall be properly fixed with all fixing screws in places.
7) All mechanical interlocks shall be checked and all fuses and links shall be inserted.
8) Earthing connections shall be checked.
9) Operational checks on all circuit breakers or switchgear shall be carried out, both mechanically and electrically to check that correct indications are provided for closed and open positions.
10) The panels shall be checked to ensure that moisture ingress has not taken place during transit and storage.

2.2 Testing at site:

1) Insulation of the main circuit, that is, the insulation resistance of each pole to the earth and that between the poles shall be measured.
2) All wiring shall be tested for insulation resistance by a 1000 volts megger.
3) All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit.
4) Insulation test shall be carried out both before and after high voltage test.

5) A high voltage test with 2.5 KV for one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed, all units racked in position and the breakers closed. Original test certificate shall be submitted along with panel.

POINTS TO BE TAKEN CARE AT ELECTRICAL INSTALLATION, FIRE ALARM, DATA CABLING & PUBLIC ADDRESS SYSTEM WORKS : -

1. The quantities indicated in the schedule of quantities are only provisional and payment will be made only as per actual as ascertained by joint measurements.

2. Single pole flush type accessories are to be provided for light, fan 6 Amps pin socket and 15A 6 pin socket points and the same is mentioned in the schedule also. For the light and fan points, provision of 3 way plated rose / pattern holder (straight or slant) is included in the specification on the wiring.

3. Earthing from D.B. to switch Board and from thereon to the 5 Amps and 15 Amps pin socket points is to be extended and the same is mentioned the schedule. For light and fan points also earthing has to be extended a indicated in the Schedule and nothing extra will be paid for this work.

4. During execution of the electrical, Fire , Data, AC works like laying the conduit, AC drain pipe, Cables, Distribution board, point wiring, fire alarm & PA work etc, cutting and chasing of wall /flooring is to done carefully and has to be restricted to the minimum and the rates quoted for the respective items of work should include for patch – filling, plastered and finishing, including painting to match the colour of wall & flooring, if required.

5. Jumper holes for taking the wiring from one room to the other are to be made to the exact requirement and FRLS sleeves of required size are to be provided for crossing the brick work and nothing extra will be paid for this work.

6. It is the responsibility of the contractor to prepare the necessary drawings, test reports, etc., that are to be submitted to the Local Electricity Board.

7. The contractor has to sign the declaration given below, agreeing to execute the service connection works at the standard schedule rates of the Local Electricity Board.

8. If the contractors have to offer any suggestion or if their rates are based on any presumption, not spelt out specifically anywhere in the tender documents they should necessarily make a suitable mention about the same, while forwarding the tender. Any such statement, after submission of the tender, will not be entertained.

9. All necessary electrical layout/fitting fixture layout/Telephone & Data cable network/,Fire Alarm layout etc shall be got approved from LICI before execution of work.

10. As built drawing layout of electrical, telephone, data cabling , Fire Alarm shall be submitted to LICI after execution work

11. Manufactures certificate/Guarantee or Warrantee certificate/ Manual of Electrical installation shall be produced as desired by LICI.

12. For structural cabling work, Fire alarm work & Public address system the experienced agency has to be engaged. Approval of agency to be obtained from LICI before execution of work.

13. All items of works are to be carried out strictly as per I.E.rules1958I.S.732,I.S.3043/1966 or their latest version. In case the tenderer observes any deviation in the provision made in the schedule of works, vis-a-vis provision of the above given publications he is advised to ;bring it out clearly while making his offer.

14. Main switches beyond 63 amps should be provided with H.R.C. fuse units. Rewirable switch fuse units beyond 63 amps will not be accepted.

15. Rates quoted by the tenderer should include for the following works unless stated otherwise:-

i) Installation of switches on slotted angle iron frame work of adequate section. The main panel board is to be installed on the floor with adequate supports from wall at the back to make the entire arrangement adequately sturdy

ii) Connecting the main switch with meter, busbar distribution board with adequate length and section of FRLS insulated leads in MS conduits or flexible conduits as per requirement of site.

iii) Labeling of the switches to indicate clearly the areas or the load being controlled by them.

iv) Connecting the earth wire run along with mains/cables etc. to the earth link by providing a suitable socket etc.

16. All busbars are to be made of tinned copper flats of given section.

17. Unless specified otherwise all busbars are to be designed taking maximum current density as 800 amps. per sq. inch.

18. All busbars are to be covered with PVC sleeves of red, yellow, blue and black colours etc indicate various phases and neutral bar clearly. Alternatively, PVC insulation tape of the aforementioned colours is to be used for identification of phases and neutral as indicated above and required holes are to be drilled and brass bolts and nuts are to be provided for tapping connections as required.

19. All locally fabricated elements of the main panel boards (such as angle iron frame work, busbar chamber, distribution board etc) should be provided with the final coat of battleship grey synthetic enamel paint after erection and all switches, busbars, distribution boards provided to main panel boards are to be labelled.

20. Drawing showing details of installation indicating very clearly the sections of slotted angle iron proposed to be used , the depth to which the members are to be grouted inside the wall, mode of their support at the floor level including grouting inside the floor should be got approved by the contractor before actual execution of work.

21. The drawing showing the arrangement of the main distribution board, floor distribution boards showing the actual dimension of switch gears, busbar chambers, distribution boards etc. should be got approved by the contractor before fabrication.

22. After execution of the work, the contractor has to submit completion reports with drawings of the entire installation showing the manner in which the work has been actually carried out in triplicate to LIC of India. This is in addition to the drawings which the contractor is required to submit with completion report/test reports he has to submit as per the requirement of the local electric supply authority.

23. It is the responsibility of the contractor to attend to the inspection of the installation if carried out by the inspecting authority of the state government as mentioned in TD 1 since the works are to be carried out strictly as per IE rules and relevant Indian Standard specifications, the defects indicated by the above given inspecting authority will have to be rectified by the contractor at no extra cost to LIC of India.

24. It is responsibility of the contractor to obtain electrical service connection to the premises. In case it is observed that the contractor is lacking in efforts to obtain electrical service to the premises the Addl.Executive Director (Engg) at his discretion may recover liquidated damages at the rate as mentioned in the respective clause of the general conditions of contract for delay in availability of electrical service and consequent delay in commissioning of the installation.

25. It will be the contractor's responsibility to check the concealed conduit work carried out by the building's contractor within a period of one month of taking over the site and to certify that the concealed conduit work is in order . In case the contractor fails to point out any defect within this period, it will be taken for granted that the concealed conduit work has been found by the contractor in order and no further complaints in this regard will be entertained. After this, all rectification work will have to be carried out by electrical contractor at his cost.

26. Insulated cables are to be laid on the walls, beams, ceilings etc. by providing plugs of well seasoned wood, cemented into the walls to within 6.5 mm of the surface. Within the electrical shaft, the cables are to be run on MS clamps made out of angle, channel or flat section of required thickness grouted in the wall securely. The cable trenches in the meter room in which the cables have been laid are to be filled up with sand.

27. The underground cables laid in the trenches are to be laid in suitable dia. Hume pipes at all road crossings. The rates quoted should include for providing Hume pipe unless specified otherwise. Cable in underground is to be laid with necessary excavation of trench of size 600 mm deep and 450 mm width and refilling up to 80 mm of the trench with sand, laying the cable and covering the cable with bricks on the three sides and back filling the excavated materials and making good the same and consolidating the excavated area complete in all respects.

28. All cable terminations inside switches, busbars, distribution and switch boards should be made in a workman like manner by providing sockets of suitable amperage, compression glands of suitable dia. porcelain connectors etc. as required. Rate quoted should be inclusive of all these accessories and nothing extra will be considered on this account.

29. Measurements for mains and cables will be taken as per IS 5908-1979 or its latest version.

30. Conduits containing FRLS insulated wires for mains/submains/circuits/point wiring are to be painted with two coats of synthetic enamel paints or British paints/Jenson & Nicholsons / Shalimar / Asian brand to match with the finished wall surface. The rates quoted should be inclusive of the cost of paintings as mentioned here.

31. All rates quoted for point wiring shall be inclusive of necessary circuit wiring with 3 x 2.5 sqmm copper conductor FRLS insulated wires of 600 V grade with distinct colours for phase, nutral and earth in appropriate size 25mm dia FRLS heavy gauge conduit and accessories concealed in beams/column/walls from the distribution board to switch board location as directed.

32. M.S. switch boxes of suitable sizes to accommodate ceiling fan regulators are to be provided on wall in concealed manner and hence the rates quoted should include for the switch boxes provision with

adequate size of 3 mm thick laminated sheet cover to be fixed on suitable size concealed M.S box with steel screws and washers.

33. 15 A power plugs are to be directly wired from the DBs and not to be looped under any circumstances.

34. The work of providing earth electrode is to be done strictly according to IS 3043-1966 or its latest version.

35. At G.I. Plate Earthing, G.I. Plate of size 600 x 600 x 6.30 mm is to be burried 2.5 mtrs below ground level. Necessary watering arrangement with suitable size G.I pipe and funnel is to be made. 2 Nos of 25 mm x 6mm G.I flats from the bottom of the plate are to be taken out and terminated to the main panel board.

36. Suitable size G.I protection pipe for GI earth flats is to be provided directly from the earth pit and upto 3 mtrs height on wall and necessary masonry chamber with hinged type lockable cast iron inspection cover of 300 x 300 mm is to be provided. Necessary alternate layers of charcoal/coke and salt are to be provided. The earth stations are to be provided with minimum 4.5 mtrs away from the foundation of the building.

37. At G.I. pipe earthing, Same as above as in G I plate earthing but with 38 mm G.I. pipe of minimum, 2.75 mtr length.

38. At copper plate earthing, Same as above as in GI plate earthing but copper plate of size 600 mm x 600 mm x 3.15 mm is to be used and 1 No of 25mmx3mm thick copper strip from the bottom of the plate to be provided as specified in the schedule.

39. For pump set motors, pipe electrodes are to be provided whereas for other electrical installation plate earthing can be provided unless stated otherwise.

40. The work of provision of earth station should include in addition to provision of earth electrodes bringing the earth leads upto test terminal block installed at a height of 2.75 mts from ground level in case of lightning conductors. The measurement for earth leads if included in the schedule of work and payable separately, the above measurement will be excluded from the separate measurement.

41. The earth resistance is to be tested with suitable earth megger and the earth electrodes are to be installed minimum 4.5 mtrs. away from the premises.

42. Street light lamp posts are to be made of 50 mm dia. G.I Pipe of 'medium' or 'B' Class of specified length with MS base plate of size 300 mm x 300mm x 10 mm welded at the bottom of the lamp post. Street light pole should be painted with two or more coats of Aluminium paint of approved make.

43. Tube light fittings on ceiling are to be fixed with suspension rods not exceeding 750 mm made out of minimum 16 gauge HGBE conduit of suitable size with necessary ball and sockets, chuck nuts etc. Ball and sockets are to be fixed to TW round blocks securely fixed on the ceiling. The down rods are to be painted with two coats of synthetic enamel paint of approved colour.

44. Fittings on the wall are to be directly fixed on the wooden round blocks of suitable size as mentioned above.

45. Ceiling fans supplied by LIC are to be assembled, tested and erected on the ceiling fan hooks already provided. FRLS insulated copper conductor wires of size 1.5 sqmm are to be used for making

connection for the ceiling fans. Regulators are to be fixed on the concealed switch boards and connections given as directed.

46. Exhaust fans supplied by LIC are to be fixed at the location as directed and the balance opening if any is to be closed properly with 6 mm thick Teak Wood ply as directed. The exhaust fans are to be provided with necessary mechanical support. When installed on walls directly, the exhaust fans are to be fixed on the four bolts securely grouted on the walls suitably.

47. The open end of the concealed conduit shall be closed with plastic plug and should flush with the plaster surface.

48. Earth studs (screws) are to be provided in switch boxes on either side of the box for earthing.

49. DETAILS FOR FIXING DBs & SWITCH BOXES :

Sl.No.	Item	Height in **mm** from F.F.L. to the bottom of the SB/DB (preferably as directed at site)	If wall glazed tiles are used in walls
1.	Distribution works	1800	
2.	Switch Box	1250	
3.	Power Plug box in bath room	1800	Clear 50mm above the wall glazed tiles levels whichever is higher is to be followed.
4.	Power Plug box for water cooler	1200	-do-
5.	Independent Power Plug point box	300	-do-
6.	Power Plug Box in kitchen	1250	-do-
7.	Power Plug Box in Tea Room	1200	-do-

TECHNICAL SPECIFICATION FOR FIRE ALARM SYSTEM

1.0 GENERAL:
1.01 DESCRIPTION:

The work shall consist of furnishing, installation, testing & commissioning of a complete high quality advanced technology early detection Intelligent Soft Addressable fire alarm system as shown on the drawings and specified herein.

1.02 REFERENCES FOR INSTALLATION:
NFA- National Fire Protection Association NFPA 72 British Standard Institute / European Standards

All Applicable codes and standards including BS EN 54
Underwriters Laboratories Inc. (UL) – USA

1.03 SUBMITTALS:

A. Product data for fire alam system components including dimensioned plans, sections, and elevations showing minimum clearances, installed features and devices, and list of materials and data.

B. Shop drawings.

C. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs. Description shall cover this specific project.

Product certification signed by the manufacturer of certifying that their products comply with any one of with specifications and Vds approval or equal the fire alarm system components the referenced standards, completely

1.04 TRANSPORTATION, HANDLING AND STORAGE:

A. All the components of fire alarm system shall be provided in manufacturer's original new and unopened packing bearing manufacturer's name and label.

B. Store materials, not in actual use, in covered and well ventilated area and protect them from dirt, dust, moisture, direct sunlight and extreme temperatures.

C. For further requirements follow manufacturer's wrtten instructions regarding storage and handling.

1.05 WARRANTY

Submit written guarantee signed by the contractor or manufacturer or installer of fire alarm system for the period of 1 year from the date of substantial completion. The guarantee shall cover the repair and replacement of material with manufacturing defects and workmanship as directed by the engineer.

1.06 QUALITY ASSURANCE:
1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems and components, whose products have been in satisfactory use in similar services for not less than 3 years period, and be subject to approval of engineer.

2. Installer Qualifications: An experienced specialist sub-contractor who is authorized by the system manufacturer, and subject to approval of the engineer.

3. All the components and installations shall comply with the requirements of DIN VDE 14675 & VDE 0833 for design & installation.

4. Provide system and components specified in this section that are listed and approved by Vds & conform to equivalent DIN/EN standards.

5. Single source responsibility: All components and accessories shall be product of signle manufacturer.

1.07 NATIONAL BUILDING CODE – 2005 LOCAL BUILDING BY-LAWS

The Video Display Terminal (VDT) shall comply with Swedish magnetic emission and X-radiation guidelines MPR 1990:10.

APPROVALS:
The system shall have proper listing and/or approval from the following nationally recognized agencies:
UL Underwriters Laboratories Inc (9thEdition)
The fire alarm control panel shall meet UL Standard 864 9th Edition (Control Units)
The system shall be listed by the national agencies as suitable for extinguishing release applications.
The system shall support release of high and low pressure CO2 / Other gas flooding systems etc.

PRODUCTS

EQUIPMENT AND MATERIAL, GENERAL:
All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.0 PRODUCTS:

2.01 SYSTEM DESCRIPTION:
A. The fire detection and alarm system shall comprise of Automatic Soft Addressable Modular design main fire alarm control panels, Dual optical smoke & heat MULTI Sensors , Blue LED Optical Smoke & Heat MULTI Sensors, Optical Smoke / Heat/ CO Gas MULTI sensors, Loop powered Dual Optical Smoke/Heat sensor with integral Sounder / Flasher / Speech units, manual call points, electronic wall mounted Alarm sounder/flasher/speech combined devices, Transponder interface units, each with its own short circuit built-in isolators. All loop cabling and any other components and accessories deemed necessary for a safe, reliable and satisfactory system shall conform to the relevant and applicable requirements and recommendations of DIN EN 54. The system shall be fully programmed to accommodate fire alarm zones. The system shall be configured to allow on site modifications with the minimum of disruption using the PC based software to facilitate future changes or alterations to existing buildings/network on site.

B. The fire alarm and detection system shall provide the following facilities as a minimum:

The system shall be intelligent in operation with advanced decentralised intelligence technology. Each detector shall have its own processor with algorithms built in the device to take a fire or fault decision. System with centarlised intelligence by providing signal levels to the control panel are not acceptable.

The system will be capable of providing fire, fault disablement and supervisory monitoring facilities as required by DIN EN 54 Pt 2. All devices on a loop shall have built in SHORT CIRCUIT LINE ISOLATORS for wiring fault isolation to protect the system. “Group Circuit Monitors” which isolate/protect sections of a loop circuit, i.e. a group of field devices are not acceptable.

All system components and devices shall be connected to two-wire loop circuits (as shown in the typical schematics) with each component having its own individual built-in isolator, should have sensors with integrated sounder in a same unit and no extra cabling should require to power up the sounder. Removal or disconnection of any component from the loop shall not affect the functioning and performance of other components and the system. Please note that the group isolators, which are used to isolate a section of a loop in case of fault, are not acceptable.

System shall be of automatically addressable type i.e. all the devices on the loops of the FACP shall be allocated addresses automatically from the PC / panel at the time of system power. The loop devices shall also be able to commission by using PC interface without the need of FACP.

And also given an address during commissioning, the value of which shall be stored in non-volatile memory, within the electronics module of the outstation. This value shall be read during loop allocation and provided it is valid shall be used to setup the outstations primary address.

Automatic Addressing shall cover the benefits of Soft Addressing and also overcome the limitations of Hard Addressing. This means that If the devices are inserted or removed all the existing devices shall keep the same address and programmed activations and use labels remain unchanged. The panel with PC shall allocate the address to ensure that it is impossible for two devices to have the same address. Fire Detection and Alarm Systems, which rely only on Coding , Programmer or hard addressing techniques are not acceptable.
Facilities shall be provided to constantly monitor and check the following circuits and fault conditions:

*The power supply to the loop /s;
*For open-circuit, short-circuit, earth fault and any other fault condition in the loop wiring;
*For communication failure and errors in all cards and loops
*For faults in keyboard and printer circuits
*All devices, etc. shall be installed on the same loop.

All devices shall be assigned a maximum of 25 character or 2 lines of max. 30 characters each with a ¼ VGA Display. In case of fire, fault or warning, the label of device sensing threshold shall appear on visual display unit of the panel.
Any event i.e. Fire, fault or warning shall be recorded with time, date and place of occurrence in the memory of FACP. These events can either be displayed on normal or ¼ VGA Dislay of the FACP or printed, as required. Provision shall be done at the fire alarm control panels to silence the loop powered alarm sounders but the visual indication shall remain until the system is reset. The detectors shall have auto learn sensitivity adjustments.

The main fire alarm control panels shall be located as shown on the schematics and the floor drawings.

2.02 GENERAL: All major component of fire alarm system shall be product of a single manufacturer and shall conform to the requirement of EN54, Vds approved and be designed acc. to DIN VDE14675 and VDE

0833 Fire Alarm Systems CODE OF PRACTICE FOR SYSTEM DESIGN, INSTALLATION AND SERVICING.
The power supply breakers for FDA system shall be marked “DO NOT DISCONNECT. FIRE ALARM SUPPLY”

2.03 ANALOGUE ADDRESSABLE FIRE ALARM CONTROL PANEL (FACP):

1. In the event of a fire being reported from the smoke/heat Detectors, activation of manual call points or sprinkler operation the sequence of alarm operation shall be as follows: If a fire condition is reported from a smoke detector then the evacuation will be done initially by the local integral sounder. Then after a certain delay (to be agreed at the time of commissioning) the evacuation message shall be announced on that fire zone only. If after 3 minutes the alarm has not been acknowledged, the evacuation message shall also be announced on the other adjacent zones. All other zones shall be given the Alert message. The evacuation of the building shall be staged in phases to allow orderly movement of people.
2. f a Manual Break Glass Unit is activated or a sprinkler flow switch is operated, then the evacuation shall be transmitted immediately to the affected fire zone plus the adjacent zones.

1. Activation of the fire alarm system shall directly initiate some or all of the following to be agreed as a part of the overall engineering policy.
a. Signal to all elevator machine rooms indicating fire status (to control lifts)
b. Release doors normally locked by magnetic devices.
c. Release doors normally held open by magnetic devices
d. Shutdown mechanical equipment ventilation plant
e. Shutdown general exhaust fans
f. Start up smoke extract fans

g. Start up exhaust make up fans
h. Start up stair vestibule pressurization fans
i. Automatically operate fire dampers
j. Initiate alert signals to panels in the adjacent office tower.
k. Sprinkler valves, flow switches and other monitored valves shall be directly supervised by the fire alarm systems.

These shall include but not limited to the following:

i. Building automation system via WINMAG OPC

ii. Emergency lighting system

iii. Security system.

2.04 SYSTEM COMPONENTS AND DEVICES
2.04.1 FIRE ALARM CONTROL PANEL:

The panel shall be modular Multifunctional computer controlled using 32 bit processor. De-centralized control and monitoring functions to be realized on the loop and spur. The panel shall be complete with, but not limited to, the following elements:

1. Visual display unit capable of displaying 8 lines 40 characters backlit display / ¼ VGA display as optional.

2. Built-in optional 40 character internal protocol thermal printer or external.

3. Built-in full numeric keyboard with function keys.

4. 64 Single Zone Indicator expandable upto 192 SZI

5. SMART Card media slot.

6. Key-switch to prevent unauthorised operation of keypad.

7. Integral sealed lead acid battery and charger, with 24 hour back up in the event of supply mains failure.

8. Essential controls – Delay, panel reset, Audible alarm off, Disconnect master box, additional messages, verify/cancel fault buzzer. Fire, Pre-Alarm, Trouble, Disconnection lamps. Each lamp shall also have appropriate indication (Releasing Systems activated, Master box, Delay , Verify, CPU failure, In operation normal condition & failure of power supply / battery) Simple menu driven function keys with password protection shall allow users to an extensive range of software based features such as:
a. Overview
b. Service
c. Time functions
d. Information
e. Last 2000 system eventsCurrent fault and warning logs.
f. Interrogation of sensor cleanliness On/Off, Enable / disable sensors, zones, sounders, interface unit channels.
g. Status of detectors
h. Alarm counters
i. Printer on, off, line feed and test facilities.
j. All control buttons and keyboard shall be enclosed behind a lockable cover, Upto 127 device capacity per 3.5km loop and a TTY/ RS 485 communication option.

k. In addition to the above, all other necessary controls, elements and accessories shall be included to provide a complete and efficient panel conforming to the requirements of DIN EN 54.

LOOP PARAMETERS:

Individual loop circuits will be capable of accommodating the following.

i. Up to a maximum of 127 addressable devices on 3.5 kms loop length
ii. Up to 32 loop powered IQ8 Alarm addressable Sounders.

iii. Up to 32 loop powered IQ8 Alarm electronic Strobes.

iv. Up to 32 loop powered combined electronic sounders and strobes

v. Up to 80 sensors with integral alarm sounder
vi. The detection loop shall have the ability to support both sensors and sounders connected on the same 2 core loop circuit.
vii. Up to 127 loop powered input modules.
viii. Should have the ability to spur off the detection loop without using 'T' breaker devices, without any degradation.

SYSTEM EVENT PRINTER:
The system printer shall be 40 character thermal printer optional in-built on the main control panel, and shall log all events, change of status, alarm and fault messages along with time of the day and date. An external 80 column dot matrix printer along with system PC is also recommended.

The printer shall provide the following:

a. Hard copy of every event occurring
b. Status read out of every addressable point
c. Devices tested on a walk test
d. Contaminated detectors needing replacement
e. Single point scan printout of analogue values
f. Hard copy of historic log.

2.06 FIELD DETECTION DEVICES
GENERAL: ANALOGUE DETECTORS & BASES
All analogue detectors and bases shall be provided by the same manufacturer of the control system. No other make of detectors will be permissible.
All analogue detectors shall have real intelligence itself. This means even without control panel the detector can make decision, adapt to different environmental condition and diagnose itself. They shall have decentralized intelligence , automatic function self test, CPU failure mode, alarm and operating data memory and integrated short circuit line isolators. The detector bases for interfacing between the loop wiring and the detector head shall be manufactured by means of injection moulded ABS plastic coloured white and shall not contain any electronics for addressing. The base fixings should be suitable for any industry standard BESA or conduit boxes. All bases shall include the option to provide a programmable relay output for interfacing, providing a dry contact for third party.

All bases shall be provided with a plastic removable dust cover for protection during site construction as well as an IP rated sealing gasket to prevent dirt and moisture from entering through from the fixing surface.

Each base shall include a lock and removal of locked detectors shall be achievable only through the use of the appropriate removal tools as specified by the manufacturer of the detectors. Detectors removal tools are to be handed over on completion of the contract as part of the spare parts to the client.

Removal of a detector from it's associated base shall not affect the continuity of the detection loop.

The Fire alarm manufacturer shall have the complete range of following analogue ADDRESSABLE automatic / manual detectors with decentralized intelligence as standard so as to meet the specific applications of the site.

1. Heat Detectors (fixed & ROR temperature)
2. Optical Smoke Detector
3. Optical Smoke & Heat Detector
4. Dual angle Optical/Heat Detector
5. Blue Light Optical / Heat Smoke Detector
6. Optical Smoke, Heat & CO gas Detector
7. Optical Smoke detector with integral Sounder
8. Dual angle Optical/Heat detector with integral Flasher
9. Dual angle Optical/Heat detector with integral Sounder
10. Dual angle Optical/Heat detector with integral Speech Sounder
11. Dual angle Optical/Heat detector with integral Flasher and integral speech sounder
12. Duct mounted sensor
13. Radio Frequency wireless analogue detectors
14. Manual Call Points

All of the above shall be compatible with the aforementioned base providing inter-changeability between detector heads, without the requirement for switch settings. All detectors shall also have an integral short circuit isolator, which in the event of a single cable fault will isolate the "culprit" piece of cable and retain all devices on the loop operationally.
Each detector shall possess two integral LED giving a red flashing indication for fire and green for normal operation. For remote locations, each detector shall be capable of connection to a remote LED unit by means of 2 core wire connection.
Detectors shall be white in colour and manufactured from ABS plastic. All electronics and associated sensing elements will be housed within this unit, these components being hermitically sealed to prevent their operation from being impaired by dust, dirt and humidity.
The sensitivity off all detectors shall be adjustable from a software. It shall be possible to programme detector sensor sensitivity directly on the loop using interface with a laptop PC and appropriate programming software from manufacturer.
For MULTI SENSOR detectors, disablement of each sensor element shall be possible individually or for whole loop. Also this disablement feature shall be possible to have manually or time / event controlled.
All detectors shall be provided with a plastic removable dust cover for protection during site construction.

A semi-flush recessing kit for analogue detectors shall be available for each detector type incorporating the standard detector base.

2.06 (a) HEAT DETECTORS
Install as shown in the drawings.These shall comply with the requirements of EN 54: Part 5 and shall be VdS approved. This shall be a dedicated heat only detector to provide fixed temperature heat as well as rate of rise sensing. It should be fully compliant with EN54 part 5 to provide grades of A1.

2.06 (b) OPTICAL SMOKE DETECTOR:
Install as shown in the drawings .Analogue Addressable Optical Smoke Detectors. These shall be of Automatic addressable Optical type with inbuilt isolator in a single head. The optical element shall detect visible smoke from slow smoldering fires. Smoke sensing design shall comply with EN 54 part 7 and shall be VdS approved. It shall have microprocessors, short-circuit isolators and all electronic components and circuitry suitable for an Analogue addressable system. The detectors shall also have 360 degree viewing LED fire indicator.
Detectors mounted in the false ceilings shall be provided with semi flush mounting kits
.

2.06 (c) MULTI-SENSOR(OT) OPTICAL SMOKE /HEAT DETECTOR
Install as shown in the drawings .These shall comply with the requirements of EN 54: Part 5 & 7 and shall be VdS approved. These detectors shall have combined two individual sensing elements to provide excellent cover for both types of fires (slow smoldering & fast free burning fires). These detectors shall be of Automatic addressable Combined Optical/Heat type.

Optical sensing shall be carried out by means of an Infra-red LED transmitting a pulse of light across an obtuse angled chamber & heat sensing shall be carried out by a thermistor, sampling the surrounding environmental temperature.

2.06 (d) MULTI-SENSOR(O2T) DUAL ANGLE OPTICAL/HEAT DETECTOR
Install as shown in the drawings .These shall comply with the requirements of EN 54: Part 5 & 7 and shall be VdS approved. This device shall combine two individual sensing elements to provide excellent cover for both “types” of fires. (Slow smouldering and fast free burning).
OPTICAL SENSING: Shall be carried out by 2 infra-red LED transmitters across 2 separate Optical detection angles. This sensor shall process both the forward and backward scattered Light caused by entering the detection chamber of device, allowing the detector to Differentiate between real smoke and non-smoke particles e.g. Steam & Dust.

HEAT SENSING: Shall be carried out by a thermistor, sampling the surrounding environmental temperature.

2.06 (e) MULTI-SENSOR (OT) Blue-light OPTICAL SMOKE / HEAT DETECTOR:

Install as shown in the drawings. These shall comply with the requirements of EN 54: Part 5 & 7. The optical measurement chamber shall be provided with latest developed blue LED sensor technology, enabling the detection of open fire, smoldering fires and fires with high heat generation (Invisible smoke sensing). These detectors shall be capable of identifying the TF1 & TF6 test fires described in EN 54-9 specifications. These detectors shall be intelligent with time related signal analysis, signal correlation of sensor data & decentralized

HEAT SENSING: Shall be carried out by a thermistor, sampling the surrounding environmental temperature.

2.06 (f) MULTI-SENSOR (OTG) OPTICAL SMOKE / HEAT / CO DETECTOR

Install as shown in the drawings. These shall comply with the requirements of EN 54: Part 5 & 7.
The sensor element of the optical/heat detector with CO shall be as per the specification for the optical/heat detector.
The CO element shall be incorporated into the optical chamber to sense the presence of carbon monoxide gas emissions from smouldering fires. In normal environments the CO element shall have a life expectancy of a minimum of 5 years.

2.06 (g) MANUAL CALL POINTS
Install as shown in the drawings. The manual initiation devices shall be electrically compatible with all of the aforementioned detector types and shall be complete with all-electronic components and circuitry for an automatic safe addressable device. The manual call point shall have an inbuilt short circuit isolator and an inbuilt microprocessor to ensure a response time of less than 1 second.
The MCP unit shall also handle all communication to the control panel. All electronic devices contained within the MCP shall be hermetically sealed so as to prevent damage from hostile environment conditions: e.g dust with minimum rating of IP43.
The MCP operating voltage shall be 8-42 volts DC, RED similar to RAL 3020. If the MCP are located in public areas a transparent cover shall be provided as a protection to prevent inadvertent activation. MCP shall be available in two designs Large & small for aesthetic purposes to architects.

The MCP shall have an input faclity to connect conventional devices. It should have an option of using either frangible glass allowing for complete removal upon operation or plastic pane resettable function. There shall be no text but SYMBOLS on the MCP (burning house /press to break).
The device can be tested functionally without the need to either remove the front cover and/or breaking the glass, with a special test key (supplied as standard). The key shall insert the underside of the MCP ensuring easy access of the key at all times.
These devices will comply fully with EN 54 part 1.
The network shall be able to accommodate intruder alarm panels.
There shall be extensive diagnostic functions on the panel to be used to localize faults caused by interference or wiring, Networking shall be capable of carrying out using a data cable e.g IBM type 1 or CAT5. The distance between each panel shall be standard 1200 meters and capable of extending upto 3000 meters using booster repeaters.

2.07 NETWORKED LCD OPERATING PANELS / REPEATER PANELS

The Repeat Panel shall be sited at the Rear Entrance, guard house or location where it is manned 24 hrs.. It shall provide system repeat facilities to repeat all of the liquid crystal display messages as well as the common indications. Repeat panel shall be interfaced for network fire alarm control panels, designed for standardised display and operation as per DIN EN 54 part 2 and DIN VDE 0833 part 2. Installation and connection to FACP shall be via the short circuit and open circuit resistant essernet. System network. RS 485 interface or TTY interface for connecting remote printers, and fire brigade shall be available. The repeaters shall have minimum three common relays freely programmable, monitored, potential free upto 24 VDC.

2.08 BATTERIES:
Batteries shall be provided and shall be the dry sealed lead-acid type. The batteries shall have ample capacity. With primary power disconnected, to operate the fire alarm system for a period of 24 hours with an optional 72 hours battery backup. Following this period of operation via batteries. The batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 30 minutes.

2.09 WIRING
All cables associated with Fire Alarm installation shall be of fire resistant 2 core 1.5 sq. mm twisted pair. Cables or other wise specified shall comply with BS 6207 Part 1. The cable is to BS 6207: Part 1 having, Typically no more than 2 cores each core having 1.5 sq. mm cross sectional area, A red cover sheath (preferred for alarm applications), Having continuous metal sheath encapsulation, Fire resistant tested to BS6387 categories CWZ.

3.0 EXECUTION

3.01 INSTALLATIONS
The entire fire alarm system shall be installed in accordance with DIN / BS EN54 Standards and manufacturer's approved shop drawings, written instructions and recommendations.

3.02 TESTING
Fire alarm system shall be tested in accordance to Local Fire Authority regulations and put into operation by the manufacturer or his authorized representative in the presence of engineer. Fault and alarm conditions shall be simulated and all data and alarm indicators checked with full events recorded on system printer according to the testing procedure.

GENERAL CONDITIONS FOR SUPPLY, INSTALLATION,TESTING AND COMMISIONING OF AIRCONDITIONING SYSTEM.

1. General

1.1 The equipment for variable refrigerant volume/flow (VRV/VRF) system shall be air-cooled consisting of Outdoor units and multiple Indoor units for cooling the space in summer and heating in winter (whenever Heat pumps are specified).
1.2 The system shall consist of suitable Outdoor units, Indoor units as required, interconnecting refrigerant piping, control cabling and accessories as required.
1.3 It shall be possible to connect multiple Indoor units on a single refrigerant circuit. The Indoor units on any circuit may be of different type and should allow individual control.
1.4 The condenser coil and condenser fans shall be sized to work even at **52°C** ambient without tripping.

2. Outdoor Unit

2.1 The Outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing, constructed form rust-proofed mild steel panels complete with powder coated finish.
2.2 Each module of Outdoor units shall consist of scroll compressor(s), air-cooled condenser as Heat Exchanger, high efficiency propeller fans with low noise motor, internal Refrigerant piping, safety controls, Air Inlet grilles, fan protection grille etc. all enclosed in weather proof housing.
2.3 The Outdoor unit shall have multiple scroll compressors and shall be able to operate even in case of breakdown of one of the compressors. (The smallest capacity unit may have only one compressor).
2.4 The Outdoor unit shall be suitable for mix and match connection of various types and capacities of Indoor units as per demand.
2.5 The noise level shall not be more than 62 dB(A) under normal operation, measured horizontally, 1 m away and 1.5m above ground.
2.6 The Outdoor unit shall be modular in design and shall allow for side by side installation of multiple Outdoor units, to match the requirement.
2.7 All the units shall be provided with built-in microprocessor control panel, for automatic operation and capacity control.
2.8 The units shall be suitable for Refrigerant R-410A.

3. Compressor

3.1 Each unit shall have single/multiple hermetically sealed scroll compressor.
3.2 The scroll compressor shall consist of two spiral disc, where one is fixed and the other rotate. The disc shall be mounted eccentrically to allow orbital movement. This shall permit compression of Refrigerant gas, as it move up between the eccentric discs.
3.3 Both the spiral disc out rotor shall be mounted on a common shaft with antifriction bearing, suitable for handling both radial and axial thrust.
3.4 The compressor casing shall be fabricated from mild steel of thickness capable of withstanding the working pressures. The casing shall have built-in oil reservoir with a sump of adequate capacity.
3.5 The compressor shall be complete with a suitable High efficiency motor hermetically sealed within the compressor housing.
3.6 The compressor housing shall also have oil reservoir for lubrication and suitable means like an oil pump or pressure differential device shall be provided to lubricate all moving parts.
3.7 One or more compressor shall be provided with suitable sine wave or equivalent DC Inverter for capacity modulation.

4. Condenser / Heat Exchanger and Fans

4.1 The condenser shall be air-cooled type, where heat exchanger shall be fabricated from copper tubes, mechanically bonded to aluminum fins to form a cross fin coil. The aluminum fins shall be given anti-

corrosion treatment. This treatment shall be suitable for areas of high pollution, moisture and salt laden air.

4.2 The condenser fans shall be with multi blades of aerofoil design for low noise level, high efficiency and fitted with a high efficiency fan motor.

4.3 The fan outlet shall be protected by a suitable wire guard on the outside.

4.4 Suitable devices and heat exchanger means shall be built-in the unit to provide maximum super-cooling of refrigerant to increase system efficiency.

4.5 The unit shall be complete with safety controls and suitable microprocessor based master control module.

4.6 The module should be capable of connecting to web or to other devices through common Bacnet or LAN networks or any other suitable networking protocol..

4.7 All the above component shall be housed in a compact mild steel cabinet having air Inlet louvers, safety guard on the condenser fan. The ambient shall be mode weather proof using suitable anti corrosion treatment and finishing point.

5. **Indoor Units (IDU)**

5.1 The system shall permit connection of a variety of non ductable or ductable Indoor units on to single refrigerant piping circuits, as per description given later.

5.2 The capacity of the IDU shall vary as per the requirement of the given area.

5.3 The types of IDU which may be connected may be any of these given below:

5.3.1 High Wall mounted Unit.

5.3.2 Cassette type of different configuration.

5.3.3 Concealed Ceiling suspended units.

5.3.4 Ceiling Suspended High static Unit.

5.3.5 Ceiling Mounted Exposed unit.

5.3.6 Floor standing (exposed or concealed) units.

5.3.7 Ductable ceiling mounted High Capacity units.

5.3 Common features of Indoor Units

5.3.8 The cooling / heating evaporator coils of the various types of Indoor Units shall be of direct expansion type.

5.3.9 The coils shall be fabricated from copper tubes of min 8 mm dia. with extended aluminium fins and designed for low velocity.

5.3.1 The fins shall be bonded to the tube using hydraulic expansion of tubes ensuring tight bonding between tube and fins for efficient heat transfer.

5.3.2 The coils shall be complete with well-designed tube circuiting and liquid distributor.

5.3.3 All types of units shall have a built in electronic expansion valve and suitable control units.

5.3.4 The control units shall control temperature, fan speed and features specific to each unit such as night mode, set back, etc.

5.3.5 Suitable drain pan and drain arrangement shall be part of all IDUs.

5.3.6 The control units shall permit control from a corded or a wireless remote controller.

6. **High Wall Mounted units**

6.1 The high wall mounted units will be complete with cross flow fan, vertical DX coil, filters, control units and plastic outer cabinet.

6.2 The cross flow fan should be of generous dia. and length to deliver the required air quantity at high speed and be very quiet with Noise level below 38 dbA.

6.3 The fan assembly shall be directly mounted on a low noise, high efficiency motor.

6.4 The DX evaporator coil and other common features shall be as given under para 5.3.

6.5 The air filter shall be electrostatic type to remove dust, pollen and other impurities.

6.6 The outer casing shall be made of high grade plastic, complete with return air grille, motorized supply air louvered opening and suitable metallic back panel for mounting all items.

7. **Cassette type units**

7.1 The cassette type Indoor Units may be of any of the three configurations, as given below and as may be mentioned in Bills of quantity.
7.2 Four way or circular air distribution arrangement whichever is specified or is available.
7.3 2-way air distribution arrangement.
7.4 1-way or corner type air distribution arrangement.
7.5 The unit shall be complete with turbo fans of multi-blade type, duly statically and dynamically balanced to give the required air flow.
7.6 The filter shall be of synthetic type to suit the configuration.
7.7 The unit housing shall have provision for connecting fresh air duct, wherever required.
7.8 The unit shall be complete with built-in high head fail-safe pump with safety cutouts.
7.9 The unit shall include all items as given in 5.3
7.10 Each type of unit shall be supplied complete with **Air distribution panel** whether specified or not.
7.11 The panel shall have removable return air core for cleaning air filter and maintaining motor etc.

8. Ductable Units

8.1 The ductable indoor units shall be ceiling suspended type, complete with fan assembly, DX coil, air filters, control units and outer casing.
8.2 The fan shall be centrifugal suction type with fan casing and direct driven motor. The fan shall have a minimum external static pressure of 100 Pa.
8.3 The air filter shall be cleanable type with mold resistant resin net fixed to an integrally moulded plastic frame. The filter shall be sliding type with frame for ease of insertion and removal.
8.4 The outer casing shall be of heavy gauge galvanized duly treated for corrosion resistance and finished with powder coated paint. It should have internal insulation to prevent condensation and absorb fan noise.
8.5 There shall be suitable deep drawn insulated drain pan.
8.6 All other component shall be as in para 5.3.

9. Indoor Control Unit

9.1 All types of indoor unit shall have one of the following controllers:
9.1.1 Cordless Type
9.1.2 Corded Type
9.2 Unless otherwise specified the controller to be provided shall be as follows:
9.2.1 **Cordless Remote:** Wall units or other units which are located in an enclosed cabin.
9.2.2 **Corded Remote:** in open offices or and areas not covered above.
9.3. The unit shall be equipped with a self-diagnosis for easy and quick maintenance and service.
9.4 The LCD (Liquid Crystal Display) remote controller shall memorize the latest malfunction code for easy maintenance.

10. Refrigerant Piping Capabilities

10.1 The unit shall be capable of long length of piping and for providing lift of Refrigerant due to level difference between the Outdoor unit and Indoor units at the highest levels.

11. Refrigerant Piping:

a. All refrigerant pipes and fittings shall be type `L' hard drawn copper tubes and wrought copper fitting suitable for connection with silver solder phos copper.
b. All joints in copper piping shall be sweat joints using low temperature brazing and/or silver solder. Before joining any copper pipe or fittings, its interior shall be thoroughly cleaned be passing a clean

cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while construction the joints. Subsequently, it shall be thoroughly blown out using carbon dioxide/nitrogen.

c. Refrigerant lines shall be sized to limit pressure drop between evaporator and condensing unit to less than 0.2 kg per Sq.cm.

d. Removable type combination drier and filter shall be installed in liquid line of the refrigeration system incorporating a three way valve bypass.

e. After the refrigerant piping installation has been completed the refrigerant piping system shall be pressure tested using, Freon mixed with nitrogen/carbon dioxide at a pressure of 20 Kg per Sq. cm. (High side) and 10 Kg per Sq. cm (Low side) pressure shall be maintained on the system for a minimum of 12 hours. The system shall then be evacuated to a minimum vacuum of 70 cm. of mercury and held for 24 hours, during which time; change in vacuum shall not exceed 12 cm of mercury. Vacuum shall be checked with vacuum gage.

f. All refrigerant piping shall be installed strictly as per the instructions and recommendations of air conditioning equipment manufacturers.

11. Testing & Balancing:

a. All piping shall be tested to hydrostatic test pressure of at least two and half times the maximum operating pressure, but not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified and gotten approved at site.

b. Piping repaired subsequent to the above pressure test shall be retested in the same manner.

c. System may be tested in sections and such sections shall be securely capped, then retested for entire system.

d. The contractor shall give sufficient notice to all other agencies at site, of his intention to test a section or sections of piping and all testing shall be witnessed and recorded by Owner's site representative.

e. The contractor shall make sure that proper noiseless circulation of fluid is achieved through all coils and other heat exchange equipment in the system concerned. If proper circulation is not achieved the contractor shall rectify the defective connection. He shall bear all expenses for carrying out the above rectifications, including the tearing up and refinishing of floors and walls as required.

f. The contractor shall provide all materials, tools, equipment, instruments, services and labour required to perform the test.

g. Complete certified report shall be submitted for evaluation and approval. Upon approval, four copies of the balancing report shall be submitted with complete drawings and documents.

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12. Refrigerant Piping

12.1 All refrigerant piping for the VRV/VRF system shall be carried out using hard drawn seamless copper pipe using either soft, half hard or hard pipes as per chart below:

12.1.1 The piping thickness shall be as follows:

OD(Inch)	OD(mm)	Min. Wall Thickness (mm)	Soft	Half Hard or Hard
1/4”	6.35	0.80	√	√
3/8”	9.52	0.80	√	√
1/2”	12.70	0.80	√	√
5/8”	15.88	1.00	√	√
3/4”	19.05	1.00	√	√
7/8”	22.20	1.00	X	√
1.1/8”	28.58	1.00	X	√
1.3/8”	34.92	1.10	X	√
1.5/8”	41.28	1.25	X	√

12.2 The branching of refrigerant piping from the main line shall be carried out using either specially designed 'Tee' connectors or 'Y' joints. These joint should ensure that each branch receives the required refrigerant flow.

12.3 All pipe sizing shall be on the basis of sizing data of the concerned manufacturer and should ensure adequate oil return back up to the compressor.

13. **Pipe Insulation**

13.1 **Refrigerant Pipe Insulation**

13.1.1 The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm thick Nitrile close cell rubber, so that condensation does not occur.
13.1.2 The joints shall be properly sealed with synthetic glue to ensure proper bonding of the ends.

14. **Drain pipe insulation**

14.1 Drain pipe carrying condensate water shall be insulated with 6 mm nitrile rubber insulation having K value 0.037 W/mk at a mean temperature of 20oC at min.density of 55 kg. /m3.
14.2 The joint shall be properly sealed with synthetic glue to ensure proper bonding of the ends.

15. **Centralized Intelligent Touch Remote controller**

15.1 A multifunctional compact centralized controller shall be provided with the system.
15.2 The Graphic controller shall act as an advanced air conditioning management system to given complete control of VRV/VRF air conditioning equipment. It shall have ease of use for the user through its touch screen. Icon display and colour LCD display.
15.3 It shall be able to control min. 21no. ODU and 80 nos. Indoor Units with the following functions:
15.3.1 Starting/stopping of air-conditioning as a zone or group of individual units.
15.3.2 Temperature setting for each Indoor units of zone.
15.3.3 Switching between temperature control modes, switching of the fan speed and direction of airflow, enabling/disabling of individual remote controller operation.
15.3.4 Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.
15.3.5 Display of air conditioner operation history.
15.3.6 Daily management automation through yearly schedule function with possibility of varying schedules.
20.3.7 The controller shall have wide screen, user friendly colour LCD display which could be wired by a non-polar 2 wire transmission cable to a desired location from the Indoor unit.

ECZO PATNA

TERMS & CONDITION OF CONTRACT FOR COMPREHENSIVE ANNUAL MAINTENANCE (CAMC) OF AIR-CONDITIONING UNITS:

1. GENERAL:

1.1 **The CAMC contract will commence automatically after successful completion of defect liability period of 12 months. During CAMC period the AC units (Indoor & Outdoor) shall be serviced quarterly in a contract year**.

1.2 In addition to the above scheduled services any complaint/breakdown call to be immediately attended and rectified within 24 hrs of receiving such complaint telephonically or through electronic mode.

1.3 The contractor shall provide its services available to the LICI during normal working hours of the corporation i.e. From Monday to Friday (9:00 AM to 6:00 PM) and 2nd & 4th Saturday (9:00 AM to 6:00 PM).

2. SCOPE OF WORK:

a. The contractor shall have to take up both preventive as well as break down maintenance jobs.. The Contractor shall have to carry out the jobs in consultation with Engineer-in-charge and have to be completed in all respect to the entire satisfaction of Engineer-in-charge, such as "Scheduled checking/servicing/overhauling of the machines as indicated in this tender document & attending the faults in the machines wherever these go out of order or work inefficiently".

b. The rates are all inclusive of establishment as well as spares and consumables likely to be required for replacement for keeping all the installations in good working condition including replacement of inverter compressors, regular compressors, refrigerant top up, condenser & evaporator coils, blowers, lubricating oils for compressor, filters, belts, valves, electronic controllers, PCBs, fuses, switches, installation of necessary software etc. if required. Nothing extra on any account shall be payable over and above the approved all-inclusive comprehensive rates of the contract

c. The replacements of all parts if any should be original, genuine make and old discarded part should be handed over to the concerned department.

d. All tools & tackles, manpower, transportation and other resources required for executing the job shall be in the scope of the contractor. No extra charges will be paid by the authority regarding tools & tackles, manpower, transportation etc.

e. The Vendor has to maintain a maintenance register during each visit mentioning what kind of job has been done during that visit. Contractor also has to provide maintenance report.

f. Scheduled maintenance work must include the following;

1. Maintenance of all filters, fans, diffusers, cooling coils, Refrigerant Gas make up etc.
2. Tightening of belts, foundation bolts of equipment, alignment of belt pulleys and couplings.
3. Examining indoor/outdoor units & operating linkage for smoothness.
4. To check the gland /seal, coupling of units.
5. To check the safety controls mechanical, Electrical/ Electronics and inter-locking of the various equipments.
6. To check all piping/insulation/proper positioning/damage and rectifying the same where ever required.
7. Inspect/check entire line for leakage and rectification of leakage, if any.
8. To check and lubricant (if required) the bearing of the fans/motors and keep the proper record.
9. To check the foundation bolts of the units/motors and to take the necessary action if required.

10. Check the quantity of Air flow from various out lets in each room/ Area and do adjustment of dampers etc as and when required.
11. Check the performance of equipment of VRF plant for proper functioning.
12. Any other job required to be attended during course of Checking and to keep the plant in perfectly working conditions.
13. Checking / setting / rectification of all safety and automatic controls.
14. Complete Overhauling of indoor/outdoor units, FCU, Fans.
15. Maintenance of Fresh Air & Exhaust Air Fans and their Balancing, if required. Observe the operation of all the dampers and make necessary adjustment in linkage and blade orientation for proper operation.
16. Functional checks & calibration of all switches, thermostats, humidistat and other instruments rectification of the same if required.
17. Any other job required to be attended during course of checking / as per OEM and to keep the plant in perfectly working conditions.
19. Maintenance of all Electrical equipment Feeders, Panels, Bus Bars, Cubicles, Motors, Heaters, Circuit Breakers, Power Points, etc. pertaining to HVAC as per standard electrical maintenance practice and as directed by concerned maintenance engineer. The maintenance and repairing of motors, Software re installation (if required) etc. are also within the Vendor's scope of work.
20. The gas charging in VRF system will be executed by vendor, whenever required.

NOTE: All the equipments/installations shall always be kept in good and trouble free operating conditions. All the required record for break-downs/repairs and maintenance etc. shall be maintained in the form of history books and logbooks etc. as per directions.

3. SPECIAL TERMS & CONDITION:

a. If closing the Air-Conditioning units for more than one day becomes necessary for major repairs/replacements/overhauls etc. the same should be pre-arranged with consultation with the concerned department and engineer in charge.
b. The contractor will be responsible for the security/insurance of their staff working at site and LICI will not be responsible in any manner in case of any accident / miss-happenings.
c. Contractors should follow all safety norms and provide necessary safety equipment at their own
cost. In case of any accident during the maintenance of the equipment or unsafe operation of air-conditioning units or its accessories leading to injuries / damages to human beings equipment and / or loss of life, the contractor shall be fully responsible for setting all claims and indemnify the Centre against any claims arising out of such accidents. Consequent damages to other systems will however be recoverable from the contractor.
d. This contract can be terminated by the LICI without assigning any reasons by giving a notice period of 30 days at any time during the period of contract. No claim for any compensation will however be entertained due to such termination prior to the expiry of stipulated period of contract.
e. The contractor has to submit a **performance security** for CAMC of the AC units in the form of bank guarantee to be valid for a period of six years from the date of expiry of defect liability period until the expiry of CAMC period. If the contractor fails to submit the BG before expiry of defect liability period then the amount will be retained from the security deposit of the contractor until expiry of CAMC period. Performance guarantee will be released to the contractor on successful completion of the CAMC period.
f. All equipment taken for CAMC during the contract period shall be handed over back to LICI in good working condition well before the end date of contract period for successful completion of the CAMC.

g. In case any equipment not handed over to LICI in good working condition, then LICI may get them repaired/procured on its own from other sources at the risk & cost of the contractor. The cost incurred shall be deducted from any payment due to him/performance security deposit.

4. PENALTY:

1. If the contractor is not able to attend and resolve the fault/complaint/breakdown calls and the reasons attributable to non performance of contractor as assessed by officials nominated by LICI then a penalty @ rate of Rs.500 /- per day may be imposed on contractor and the same will be deducted from the CAMC amount due to the contractor. The penalty clause is applicable if the air-conditioning unit remained non-functional **for 4 hrs or more**. The penalty will be Rs.500/- per day.
2. If contractor is not able to rectify the fault then the same may be got done through some other agency at the risk and cost of contractor failing which the same amount will be deducted from AMC bill in addition to the penalty as stipulated above will also be imposed. However, the decision of the Addl.Executive Director (Engg), LICI in this regard shall be final and binding.

3. If unsatisfactory performance is continued for more than two days as felt Addl.Executive Director (Engg), LICI then CAMC is liable to be terminated and final decision for this shall rest with the Addl.Executive Director (Engg), LICI. No claim for any compensation will however be entertained due to such termination prior to the expiry of stipulated period of contract.

5. PAYMENTS:

a. Payment shall be made on quarterly basis after completion of service and submission of bills along with service report duly certified by the concerned department officials or Engineer-in-Charge at the end of each quarter after due scrutiny and examination.
b. CAMC charges are inclusive of all taxes excluding GST which shall be paid extra as per prevailing rates at the time of billing.

6. CONTRACT PERIOD:

The CAMC will be valid for a period of six years starting from date of completion of defect liability period.

The supply, installation, testing and commissioning of Air conditioning work is to be carried out by the manufacturer of approved makes or their authorized dealers only. The approval of the agency for AC work is to be obtained from competent authority before commencement of work.

DEFECT LIABILITY PERIOD:

The contractor shall be responsible for any manufacturing defect or defects in installation & performance and the same will be rectified immediately at his own cost to the entire satisfaction of Engineer-in-charge during Defect Liability Period of 12 months, reckoned from the date of virtual completion.

TRAINING TO STAFF:

During the erection and testing the contractor will have to train personnel of LICI regarding operation and preventive maintenance of the AC units. Operating & maintenance instructions shall be supplied at the time of delivery of equipment at site without any extra charges.

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SPECIAL NOTE FOR CONTRACTORS;

1. Refrigerant piping wherever used shall be properly installed & bends shall be made using tube bender.
2. Where pipes & / or cables pass through walls or ceilings, proper G.I. pipe sleeves shall be provided whether the same is specifically mentioned or not, no separate rates will be applicable.
3. Refrigerant pipes shall be mounted on teak wood gutties / other suitable material to avoid physical contact with structure & shall be properly clamped & neatly laid, no separate rates will be applicable.
4. All tools & tackles, instruments & manpower required for testing (including witness test by LIC Engineers) shall be arranged free of cost by the contractor as & when required including for re-test if any.
5. Free periodic services for maintenance shall be provided by the contractor not less than ONE SERVICE IN THREE MONTHS to ensure efficient operation of the system.
6. Grouting for supports of contractors equipment shall be carried out by the contractor.

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7. The contractor shall carry out the tests on different equipments as specified in various sections, in the presence of LIC Engineers in order to enable them to determine whether the plant & equipments & installation in general comply with the specifications.
8. The Installation shall be handed over to LICI after satisfactory testing & after necessary rectifications as required along with one document of each comprising:-
   - Detailed equipment data as approved by LIC;
   - Manufacturers maintenance & operation manuals;
9. In case the test readings are not satisfactory, the contractor shall carry out all modifications to achieve the specified conditions within a period of 3 months from the test date.
10. On completion of DLP the AC units have to be handed over to LIC/New appointed agencies in proper working condition. Failing to so the units will be repaired at contractors risk and cost.
11. Contractor has to submit the layout, Location of indoor and outdoor unit along with heat load before commencement of work.
12. LIC of India will provide supply with MCCB/MCB control of adequate rating to each outdoor condensing units. Necessary cable for interconnection and switchgear is to be provided by contractor.
13. The rate quoted for the above shall include all necessary preparatory works for installing outdoor units and indoor units, chasing wall, flooring for drain pipes , refrigerant pipe etc and making them good to satisfaction of LIC. Nothing extra will be paid on this account.
14. TENDERERS ARE REQUESTED TO VISIT THE SITE BEFORE QUOTING
15. The rate quoted should include all electrical interconnections between control panel, indoor and outdoor units.
16. Any alternation, deviating tender will be summarily rejected under the discretion of the competent authority.
17. Tenders are requested to note that the final bills will be settled on completion of work in all respect of all trades.
18. containing to equipments, as built drawings, test certificate, inventory, etc.

24. The contractor shall submit drawing, Location of Indoor & outdoor unit, Layout of refrigerant pipe & Drain pipe for approval from LICI before commencement of work.

i. **Please note all the AC units are to be supplied must have copper condenser & copper cooling coil only.**

ii. The price quoted shall also be inclusive of followings :-

i) MS angle support for holding the AC units as per standard installation.

iii) Minor civil works like cutting holes, minor modification of extg pockets of ACs, etc. and throwing away any debris coming out of this work as per direction-in-charge of LICI and making good the same.

PRECEDENCE FOR ACCEPTANCE :

If the contradiction or variance is observed in different components of the tender's the details clearly given in -

a) "General Preamble" shall have the precedence over the relevant details given in General "Specifications".

b) "Trade Preambles" shall have the precedence over the relevant details given in "General Specifications"

c) The description of an item of the "Schedule of Quantities" shall have the precedence over the relevant details given in "General preambles", General "Specification" and "Trade preambles".

C E R T I F I E D

THAT THE PERCENTAGE RATE IS QUOTED IN THE “PRICE- BID” AFTER ACTUAL VISITING SITE OF WORK AND ACQUAINTING WITH THE NATURE OF WORK & WORKING CONDITION. THAT WE HAVE CAREFULLY STUDIED THE CONDITIONS OF CONTRACT AND SPECIFICATION FOR MATERIAL AND WORKMANSHIP AND WILL ADHERE TO THE SAME.

FORFEITURE OF EARNEST MONEY DEPOSIT.

1) If the lowest tender withdraws his tender before the expiry of validity period or before the issue of letter of acceptance whichever is earlier or makes any modification in the terms and conditions of tender which are not acceptable to department, then the department shall, without prejudice to any other right or remedy be at liberty to forfeit 25% of the earnest money and to refund the balance.

2) If the contractor fails to furnish the prescribed performance guarantee within the prescribed period or duly approved extended period ,50% earnest money will be absolutely forfeited automatically without any notice and the balance 50% will be refunded.

3) In case of forfeiture of earnest money as prescribed above, the tenderer shall not be allowed to participate in the tendering process of the work.

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GENERAL CONDITIONS FOR MAINTENANCE OF AIR CONDITIONING UNITS DURING DEFECT LIABILITY PERIOD

1. A.C. units shall be serviced once in **three months.**
2. In case any defect cropped up, it shall be attended within **04 hours** of getting information over telephone as and when is required. If defect requires machine to be shut down for more than three days or to be taken to factory, a stand by machine has to be provided.
3. Contractor has to give proper authorization of Engineer/Supervisor responsible for maintenance of units and has to provide their contact number so that we can contact them as and when required.
4. A.C. units are to be left operative every time in summer/winter and all components including compressor to be checked properly.
5. Compressor if found defective shall be replaced with new compressor of same make without any extra charges.
6. Entire refrigeration system to be checked if required gas will be charged as and when necessary.
7. In case the services rendered by the contractor are not found satisfactory, during any time of defect liability period, LIC will engage some other agency to carry out the work at contractors' risk & cost and the amount spend shall be recovered from Security Deposit.
8. Safety controls should be tested and replaced in case of mal functioning.
9. Air filters to be cleaned and if required to be replaced.
10. Cooling coil to be inspected and cleaned if necessary.
11. Blower motor to be checked and defects noticed will be attended.
12. Any defect in electrical items and central wiring to be attended.
13. At least one overhauling of units to be carried out during DLP period.

LIST OF PRINCIPAL / APPROVED MAKES FOR ELECTRICAL WORKS

Sr. No.	MAKES /AGENCIES / BRANDS	Sr. No.	MAKES /AGENCIES / BRANDS
1	**COPPER CONDUCTOR PVC INSULATED FR GRADE WIRES**	2	**PVC INSULATED ARMOURED CABLES (LT/HT)**
	a. Finolex		a. Finolex
	b. Havells		b. Fort Gloster
	c. V Guard		c. CCI
	d. R R Kabel		d. R R Kabel
	e. KEI		e. Delton
	f. Svarn		f. KEI
	g. Rallison		g. Havells
	h. Polycab		h. Svarn
	i. Delton		i. Rallison
			j. Polycab
3	**MAIN SWITCH WITH HRC FUSES**	4	**MAIN SWITCHES WITH REWIREABLE FUSE**
	a. L&T		a. L&T
	b. Siemens		b. Crompton
	c. Havells		c. Havells
5.	**MCCB**	6	**MCB/ELCB/ELMCB/DB**
	a. Siemens		a. .Legrand
	b. L&T		b. Siemens
	C. Schneider-MJ		c. Schneider-MJ
	d. Legrand		d. L&T
	e. Havells		e. Havells
7	**CHANGE OVER SWITCH /SWITCH FUSE UNIT UPTO 100AMP**	8.	**CHANGE OVER SWITCH /SWITCH FUSE UNIT ABOVE 100AMP,**
	a. HPL		a. HPL
	b. L&T		b. L&T
	c. Havells		c. Siemens
	d. Siemens		d. Havells
9	**RISING MAINS**	10	**PVC CONDUIT(ISI MARK)**
	a. GEC		a. Precision
	b. Schneider -MJ		b. Avon plast
	c. L&T		c. Essarke
	d. Siemens		d. Sudhagar
	e. Legrand		e. Kalinga
			f. AKG
			g. Finolex
11	**PVC CASING CAPING**	12	**M. S. CONDUIT**
	a. Precision		a. Supreme
	b. Kalinga		b.BEC
	c. AKG		c.NIC
	d. Sudhakar		d. AKG
	e. Diamond		
	f. Modi		
13	**FLOOR TRUNKING SYSTEM**	14	**G. I. PIPE**
	a. Legrand		a. Jindal
	b. Honey well		b. Senith
	c. Precision		c. Prakash

	d. Modi		d. TATA
			e.GST
			f. Apollo
15	**MODULAR SWITCHES, ACCESSORIES &ELECTRONIC REGULATOR**	**16.**	**NON MODULAR SWITCHES , ACCESSORIES &ELECTRONIC REGULATOR**
	a. Anchor		a. Anchor
	b. SSK		b. Leader
	c. Leader		c. SSK
	d. Havells		d. CPL
	e. Honey Well		e. Havells
	f. L & T		f. L & T
17	**INDUSTRIAL PLUG &SOCKET**	**18 i)**	**CEILING /EXHAUST /WALL FAN**
	a. Legrand		a. Usha
	b. Havells		b. Crompton
	c. Crompton		c. Orient
	d. L&T		d. Bajaj
	e. Anchor		e. Almonard
	f. Honey well		f. Havells
			g. Rallison
18 ii)	**BLDC FANS**	**19**	**INDOOR LIGHT FITTINGS / LAMPS**
	a. Usha		a. Philips
	b. Crompton		b. Wipro
	c. Orient		c. Crompton
	d. Bajaj		d. GE
	e. Almonard		e. Havells
	f. Havells		f. Osram
	g. Rallison		g. Bajaj
	h. Atomberg		h. Elenserve
			i. Jaquar
			j. Banburry
20	**OUT DOOR LIGHT FITTINGS / LAMPS**	**21**	**CABLE GLANDS**
	a. Philips		a. Comet
	b. wipro		b. Dowells
	c. Crompton		c . Braco
	d. GE		d. Siemens
	e. Havells		
	f. Osram		
	g. Bajaj		
	h. K-LITE		
	i. Elenserve		
	j. Jaquar		
	k. Banburry		
22	**LUGS**	**23**	**CONNECTORS**
	a. Dowells		a. Elmex
	b. Comet		b. Connectwell
	C. Braco		c. Phoenex
			d. Wago
24	**MOTOR STARTER**	**25**	**MONOBLOCK PUMP**
	a. Siemens		a. Kirloskar
	b. L & T		b. Crompton
	c. Crompton		c. CRI

	d. kirloskar		d. Wilo
	e. Texmo		e. Grundfos
	f. Suguna		f. Texmo
	g. KSB		g. Suguna
	h. Sharp		h. KSB
	i. Mahindra		i. Sharp
	j. Decon		j. Mahindra
			k. Decon
26	**LIGHTERNING ARRESTOR**	**27**	**TRANSFORMER**
	a. Pactil		a. Pactil
	b. Heco		b. Emco
	c. Atlas		c. Crompton
	d. G.K. Electricals		d. Kirloskar
			e. GEC
			f. Tesla
			g. Voltamp
			h. BHEL
			i. Areva
28	**A.B. SWITCH & D.O. FUSE**	**29**	**SELECTOR SWITCH**
	a. Pactil		a. Kaycee
	b. Jenco		b. Siemens
	c. Crompton		c. C & S
	d. Atlas		d. AE
			e. L&T
30	**INDICATING LAMPS**	**31**	**CONTACTORS**
	a. Vaishno		a. Siemens
	b. Essen		b. L & T
	c. Philips		c. ABB
	d. L&T		d. Schnieder-mj
	e. GE		
32	**MEASURING INSTRUMENTS**	**33**	**PF IMPROVEMENT CAPACITOR & APFC PANEL**
	a. AMP		a. EPCOS
	b. Meco		b. Neptune
	c. AE		c. L & T
	d. Enercon		d. Crompton
	e. PROK-DV's		e. Havells
	f. L&T		
34	**RELAY FOR AUTOMATIC PF IMPROVEMENT**	**35**	**CURRENT TRANSFORMER**
	a. EPCOS		a. AE
	b. Conzerve		b. Rishabh
	c. L & T		c. Kappa
	d. Havells		d. L&T
36	**DATA CABLES & FACTORY MADE PATCH CHORDS**	**37**	**INFORMATION OUTLET / RJ 45 CONNECTORS / RJ – 11 SOCKETS**
	a. Legrand		a. D -Link
	b. D- Link		b. Legrand
	c. Finolex		c. Molex
	d. Molex		d. Systemax
	e. AMP		e. AMP
	f. KEI		
	g. Poly cab		
38	**TELEPHONE WIRES**	**39**	**RG 6 CABLE FOR TV**

	a. Finolex		a. FInolex
	b. Delton		b. Delton
	c. Havells		c .National
	d. RR KABEL		d. KEI
	e. KEI		e. Poly cab
	f. Poly cab		
	g. Rallison		
40	**JACK PANEL**	**41**	**RACK**
	a. D- Link		a. Valrack
	b. Legrand		b. Digitron
	c. Molex		c. HCL
	d. Systemax		d. A Link
	e. Valrack		e. D-Link
	f. AMP		
42	**FIRE ALARM PANEL**	**43**	**SMOKE / HEAT DETECTOR**
	a. Honey well / System sensor		a. Apollo
	b . Notifier		b. Morley ias
	c. Mircom/ Secutron		c. Edward
	d . Morley ias		d. System sensor / Honey well
	e. Ravel		e. Mircom /secutron
	f. Agni		f. Notifier
			g. Ravel
			h. Agni
44	**MANUAL CALL POINT / HOOTER/ RESPONSE INDICATOR**		
	a. Honey well /System sensor		
	b. Notifier		
	c. Simplex		
	d. Mircom/ Secutron		
	e . Morley ias		
	f. Ravel		
	g. Agni		

LIST OF PRINCIPAL / APPROVED MAKES FOR FIRE FIGHTING WORKS

Sl. No.	ITEM	MAKE
1	FIRE Pumps	KIRLOSKAR / CROMPTON GREAVES/ CRI
2	Hydrant (Landing) Valve. Conforming to IS-5290	NEW AGE / EVERSAFE / MINIMAX / SAFE GUARD
3	Fire delivery hose-IS-636-type-B fitted with delivery hose coupling-conforming to IS-903	NEW AGE / EVERSAFE/CRC / JAYSHREE
4	Short branch pipe universal-conforming to IS-2871	EVERSAFE / VIKING/GE / MINIMAX / NEWAGE / SAFE GUARD
5	Hose cabinet :	NEW AGE / EVERSAFE / MINIMAX / SAFE GUARD
6	Isolation valve	KIRLOSKAR / LEADER / ZOLOTO / ORIENT
7	Non-return valve	KIRLOSKAR / LEADER / ASHOKA / KARTAR
8	**Fire service inlet**	EVERSAFE /NEW AGE / MINI MAX / SAFE GUARD
9	First Aid Hose Reel Swinging Type:-	EVERSAFE / NEW AGE / MINI MAX / SAFE GUARD.
10	Piping	JINDAL / ZENITH / APOLLO / GST / PRAKASH / QST
11	Pressure Gauge	H GURU / DWYER / FIEBIG / INDFOS / DANFOSS
12	Butterfly Valve	AUDCO / DANFOSS / CASTLE / KARTAR
13	**Fire Alarm Control Panel**	HONEY WELL / NOTIFIER / MORLEY IAS / MIRCOM / SECUTRON / ZICOM
14	Manual call Point	HONEY WELL / ZICOM / NOTIFIER / SIMPLEX / MIRCOM / SECUTRON
15	Hooter	HONEY WELL / ZICOM / NOTIFIER / SIMPLEX / MIRCOM / SECUTRON
16	Connecting wire / Cable	FINOLEX / HAVELLS / V GUARD / RR CABLES.
17	PVC Conduit	AKG / PRECESSION / AVON PLAST / ESSARKE / SUDHAKAR / KALINGA
18	Carbon dioxide type portable fire extinguisher	EVERSAFE / FIRESHIELD / MINIMAX / CEASE FIRE
19	ABC type stored pressure portable fire extinguisher	EVERSAFE / FIRESHIELD / MINIMAX / CEASE FIRE
20	Water Co2	EVERSAFE / FIRESHIELD / MINIMAX
21	Fire Sprinkler flexible hose (UL listed)	HD/ NEW AGE/ TYCO
22	Sprinkler bulb (UL Listed)	HD/ NEW AGE/ TYCO

SITC of VRV/VRF / MRV system

Sl. No.	ITEM	MAKE
1	High side Equipment	
1.1	VRV/VRF/ MRV system using compressor of following make only.	Carrier, Daikin, Hitachi, Blue Star, Voltas, Toshiba
2	Y-Joints VRV/VRF system	Carrier, Daikin, Hitachi, Blue Star, Voltas, Toshiba
3	Fans	
3.1	Propeller fan	Caryaire, Kruger, Nuaire (UK) , Nicotra
4	Cables & accessories	
4.1	Control Cables	Skytone, Universal, Delton, Finolex, RR , Polycab
4.2	XLPE/ PVC insulated Aluminium Conductor Armoured Power Cables	Skytone, Universal, Havells, RPG Asian, INCAB
4.3	Communication cable	Fusion, Comscope, Contemp, Finolex, RR, Armaflex, Polycab
4.4	Cable Gland Double Compression with Earthing Links	Power, Gripwell, Baliga Lighting Ltd.
4.5	PVC Insulated Copper Conductor standard Flexible wires	Finolex, National cables-NC, Polycab, Skytone, Havells
4.6	PVC Conduits & accessories (BIS approved)	BEC, Precision, D Plast, Polypack
4.7	MS/GI Conduits (ISI Approved)	BEC, AKG, Steel Kraft
4.8	Accessories for MS/GI Conduits (ISI Approved)	Sharma sales corporation, Super Sales corporation.
4.9	Bimettalic Cable Lugs	Hex(Brass copper Alloy India Ltd), Dowell's (Biller India Pvt Ltd.)
4.10	Lugs (Tinned Copper)	Dowell's
4.11	Perforated /Slotted cable tray	Kelp, Fletco, MM Enterpries
5	Ducting and Grilles	
5.1	Grilles/ Diffusers	Caryaire, Ravistar, Mapro, Tristar, Cosmic
5.2	Fire Dampers	Caryaire, Conaire, Cosmic, Ravistar, Mapro
5.3	G. I. Sheet Metal Duct	Jindal, National, Tata

SCHEDULE OF QUANTITY

NAME OF THE WORK:- PROPOSED WORKS OF ELECTRICAL INSTALLATIONS, AND AIR CONDITIONING SYSTEM FOR SO Bikramganj

SL NO	DESCRIPTION OF WORK	QTY	Unit	Rate (Rs.)	AMOUNT (Rs.)
1.00	**ELECTRICAL INSTALLATION**				
1.01	**ELECTRICAL DISTRIBUTION PANNEL (For AC & Lighting Distribution)**				
	SITC of Electric distribution control Panel floor/wall mounting type fabricated out of MS angle iron frame and CRCA sheet steel (Two Different compartment separated with full partition and independent metering and and phase indication lamps) with following accessories and separate busbar chamber of adequate size with removable front cover plate and four nos of **tinned copper busbar of size 4 nos (25 x 3 x 500) mm** mounted on porcelain insulators and drilled holes for connecting the wire leads ,danger notice board etc.The busbars are to be provided with separation space of 50 mm in between busbars & on all the sides around.	1	Set	53675.00	53675.00
	Earthing of individual switches to the pannel board shall be provided by means of 2 x 8 SWG copper wire & provision shall be made to connect the earth connection received from earth pit to the earth busbar.				
	All interconnections & connection between switch gears (MCCBs/ Change over switch) shall be made from suitable size copper bus bars / adequate capacity PVC insulated flexible copper conductor wires by socketing methods.**The incoming & outgoing connections of the MCCBs of capacity 250 Amps & above are to be made by providing suitable size copper flats as extension to the spreader links of the MCCB. All MCCBs are to be of Thermal Magnetic Release type.**				
	A separate instrument chamber shall be provided for flush type Digital Ammeter, Digital Voltmeter, Selector Switch, CT's. PT's with Red, Yellow, Blue colour indicating lamps.				
	NOTE:(DRAWING OF THE PANNEL BOARD SHOULD BE GOT APPROVED BY LICI PRIOR TO FABRICATION.)The panel board should consist of the following :-				
	1- 63- 100 Amp. 415 Volts, 4 pole, 25 KA MCCB-1				

	set.				
	2- 25x3x500 mm x 4 Nos. tinned copper Bus bars along with insulators etc. - 1 set				
	3- 3 Phase multifunction meter (for voltage, current, Freq, PF, kW, kVA) - 1 nos.				
	4- 6-32 Amps, 415 Volts, 4 pole MCB "C" SERIES WITH 10 KA breaking capacity. - 1 No.				
	5- 6- 32 Amps, 230 Volts, DP MCB "C" SERIES WITH 10 KA breaking capacity. - 8 Nos.				
	6-63 Amp 4 pole on load change over				
	7- 3 Ph. Indicators (R,Y.B) - 1 Set				
1.02	Supply & laying of following size XLPE insulated **aluminium conductotr** armoured cable 1100 volt grade along with 2 runs of GI wire as earth wire as mentioned against each item on the surface of the wall or underground as the case may be with the help of GI saddles on the surface of the wall or ceiling with spacers including termination on either end with required size of aluminium sockets .Rate is inclusive of suitable size cable glands.(Manufacturers test certificates are to be submitted to LICI)				
a	4 Core 16 Sq.mm (Al/A)	10	Meter	271.00	2710.00
b	3.5 Core 25 Sq.mm (Al/A)	25	Meter	313.00	7825.00
c	3.5 Core 50 Sq.mm (Al/A)	25	Meter	518.00	12950.00
1.03	supply & laying of following size XLPE insulated **Copper conductotr** armoured cable 1100 volt grade along with 2 runs of HDBC wire as earth wire as mentioned against each item on the surface of the wall or underground as the case may be with the help of GI saddles on the surface of the wall or ceiling with spacers including termination on either end with required size of aluminium sockets .Rate is inclusive of suitable size cable glands.				
a.	2 Core 6 sq mm.Cu.+1 Run of 14 SWG HDBC wire	5	Rm	186.00	930.00
b.	2 Core 4 sq mm.Cu.+1 Run of 14 SWG HDBC wire	25	Rm	146.00	3650.00
1.04	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator)				
a	8 way , Double door	1	Set	1806.00	1806.00
b	12 way , Double door	1	Set	2106.00	2106.00

1.05	Supplying & fixing compact power unit for Air conditioner of North-West make Cat No. ACPU6MBT (J/G/K), or its equivalent, complete with starter, 32 Amps "C" series DP, MCB, plug socket with matching plug top, metal box in concealed manner, including necessary connections & earthing (For Spli A.C)	6	No.	1248.00	7488.00
1.06	**Circuit/Submain Wiring in PVC Conduit:**				
	Wiring for circuit/ sub main wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed medium class PVC conduit as required.				
a	2 X 4 sq. mm + 1 X 4 sq. mm earth wire	100	RM	298.00	29800.00
b	4 X 6 sq. mm + 2 X 6 sq. mm earth wire	10	RM	673.00	6730.00
	TRADE SUMMARY				129670.00
2.00	**AIRCONDITIONING SYSTEM**				
	Note :- Prior to commencement of work, the firm is required to prepare the layout as per the modernization drawing and submit the same to LICI for approval and the rates are inclusive of the same.				
2.01	Supply, Installing, testing and commissioning of following type of **HIGH WALL SPLIT AIR CONDITIONERS UNITS** having ROTARY compressor and all accessories consisting of high wall mounting type indoor units with remote control and outdoor unit consisting of compressor , condensor coil , condensor fan with single phase 240 volt + 10 % or - 10% ac supply ,protection unit for under voltage complete in all respect. The out door unit is to be installed on terrace/outdoor with suitable size of M.S frame, its legs grouted by using cement & sand etc. OR installed on outer wall duly supported with suitable size of MS angle iron frame of balcony Type & channel of adequate capacity, Strong enough to take load of machine and mechanics, including providing anti vibration pads	-			
(a)	**1.5 TR INVERTER SPLIT AC UNITS (5 Star Rated)**	0	Set	44464.00	0.00
(b)	**2.0 TR INVERTER SPLIT AC UNITS (5 Star Rated)**	2	Set	51882.00	103764.00

2.02	SITC of following Cassette split, Invertor AC unit with one indoor and one outdoor units , 4 / 5 Star BEE labeled energy efficient AC unit with Rotary type compressor, air deflection system and all accessories complete with LCD remote control unit (including operational batteries) filling of R-32 Refrigeration gas, Control cable between indoor and out door unit & suitable for & suitable for operation on 50 HZ single phase A.C. supply etc. the cost shall be inclusive for necessary angle support for mounting AC unit, minor modification of Window, necessary plywood frame work for blocking air leakage. (Rate is inclusive of up to 3mtr length of refrigerant piping for Hi wall split AC.) (CAT no. shall be specified along with Technical literature.) .				
	Note: All AC units shall have copper condenser coil. Makes for Air conditioners- Voltas/ Carrier/ BlueStar / Hitachi**.**				
a.	2.0 TR Cassate AC	4	Set	85000.00	340000.00
2.03.a	Supply & installation of 4.0 KVA, single phase Voltage Stabilizer with Hi / Low Voltage cut off & time delay of Voltas / V-guard / Vintek / Blue Bard / Camipro / Logic Star make.	0	Each	3140.00	0.00
2.03.b	Supply & installation of 5.0 KVA, single phase Voltage Stabilizer with Hi / Low Voltage cut off & time delay of Voltas / V-guard / Vintek / Blue Bard / Camipro / Logic Star make.	2	Each	4134.00	8268.00
2.04	Providing & fixing following size of Rigid PVC Drain pipe with all accessories etc. complete on wall/ beam/ ceiling in concealed manner by chasing wall/ floor or on surface including providing of U trap to avoid sweating/ condensation specially on false ceiling up to a height of one meter above the plinth protection.				
(a)	25mm dia	100	Rm	93.00	9300.00
2.05	Providing & fixing refrigerant copper pipe of required size with nitrile rubber/Heatlon insulation for following size of A.C. Units with the help of GI sadling on wall or with suitable hangers from the ceiling as the case may be . **(Note: The measurement shall be taken for the refrigerant pipe including the control cable from ODU to IDU and all the three items (suction, pressure & control cable) shall be considered as one run). (The measurement will be taken in running meter excluding 3.0 meter length for split AC).**				
(a)	1.5/2 TR Highwall split units	40	Rm	580.00	23200.00
(b)	1.5/ 2.0 TR Cassette AC of 2.0 Ton	110	RM	685.00	75350.00

2.06	SITC OF CABLE FOR AC UNIT :-3 C x 2.5 sq mm PVC insulated copper cable for individual split ac unit from AC sub pannel	50	Rm	111.00	5550.00
	TRADE SUMMARY				**565432.00**
	SUMMARY				
SL. NO.	**DESCRIPTION**				**AMOUNT**
6.00	**AIRCONDITIONING SYSTEM**				**565432.00**
1.00	ELECTRICAL INSTALLATION				129670.00
	TOTAL ESTIMATED COST				**695102.00**

Note :- Qty mentioned above are Provisional, Exact qty of the work shall be determined as per execution as instructed by the engineer during the visit for handing over of site for commencement of work.

Contractor

Chief Engineer

SCHEDULE OF QUANTITY					
NAME OF THE WORK:- PROPOSED WORKS OF ELECTRICAL INSTALLATIONS, DATA & TEL. CABLING, FIRE ALARM AND AIR CONDITIONING SYSTEM FOR SO Dighwara					
SL NO	**DESCRIPTION OF WORK**	**QTY**	**Unit**	**Rate (Rs.)**	**AMOUNT (Rs.)**
4.00	**ELECTRICAL INSTALLATION**				
4.02	**ELECTRICAL DISTRIBUTION PANNEL (For AC & Lighting Distribution)**				
	SITC of Electric distribution control Panel floor/wall mounting type fabricated out of MS angle iron frame and CRCA sheet steel (Two Different compartment seperated with full partition and independent metering and and phase indication lamps) with following accessories and separate busbar chamber of adequate size with removable front cover plate and four nos of **tinned copper busbar of size 4 nos (25 x3 x 500) mm** mounted on procelain insulators and drilled holes for connecting the wire leads ,danger notice board etc.The busbars are to be provided with separation space of 50 mm in between busbars & on all the sides around.	1	Set	53675.00	53675.00
	Earthing of individual switches to the pannel board shall be provided by means of 2 x 8 SWG copper wire & provision shall be made to connect the earth connection received from earth pit to the earth busbar.				
	All interconnections & connection between switch gears (MCCBs/ Change over switch) shall be made from suitable size copper bus bars / adequate capacity PVC insulated flexible copper conductor wires by socketing methods.**The incoming & outgoing connections of the MCCBs of capacity 250 Amps & above are to be made by providing suitable size copper flats as extension to the spreader links of the MCCB. All MCCBs are to be of Thermal Magnetic Release type.**				
	A separate instrument chamber shall be provided for flush type Digital Ammeter, Digital Voltmeter, Selector Switch,CT's.PT's with Red,Yellow,Blue colour indicating lamps.				
	NOTE:(DRAWING OF THE PANNEL BOARD SHOULD BE GOT APPROVED BY LICI PRIOR TO FABRICATION.)The panel board should consist of the following :-				
	1- 63- 100 Amp. 415 Volts, 4 pole, 25 KA MCCB- 1 set.				
	2- 25x3x500 mm x 4 Nos. tinned copper Bus bars along with insulators etc. - 1 set				

	3- 3 Phase multifunction meter (for voltage, current, Freq, PF, kW, kVA) - 1 nos.				
	4- 6-32 Amps, 415 Volts, 4 pole MCB "C" SERIES WITH 10 KA breaking capacity. - 1 No.				
	5- 6- 32 Amps, 230 Volts, DP MCB "C" SERIES WITH 10 KA breaking capacity. - 8 Nos.				
	6-63 Amp 4 pole on load change over				
	7- 3 Ph. Indicators (R,Y.B) - 1 Set				
4.03	Supply & laying of following size XLPE insulated **aluminium conductotr** armoured cable 1100 volt grade along with 2 runs of GI wire as earth wire as mentioned against each item on the surface of the wall or underground as the case may be with the help of GI saddles on the surface of the wall or ceiling with spacers including termination on either end with required size of aluminium sockets .Rate is inclusive of suitable size cable glands.(Manufacturers test certificates are to be submitted to LICI)				
a	4 Core 16 Sq.mm (Al/A)	10	Meter	271.00	2710.00
b	3.5 Core 25 Sq.mm (Al/A)	25	Meter	313.00	7825.00
c	3.5 Core 50 Sq.mm (Al/A)	25	Meter	518.00	12950.00
4.04-a	supply & laying of following size XLPE insulated **Copper conductotr** armoured cable 1100 volt grade along with 2 runs of HDBC wire as earth wire as mentioned against each item on the surface of the wall or underground as the case may be with the help of GI saddles on the surface of the wall or ceiling with spacers including termination on either end with required size of aluminium sockets .Rate is inclusive of suitable size cable glands.				
c	2 Core 6 sq mm.Cu.+1 Run of 14 SWG HDBC wire	5	Rm	186.00	930.00
d)	2 Core 4 sq mm.Cu.+1 Run of 14 SWG HDBC wire	25	Rm	146.00	3650.00
4.09	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator)				
a	8 way , Double door	1	Set	1806.00	1806.00
b	12 way , Double door	1	Set	2106.00	2106.00

4.27	Supplying & fixing compact power unit for Air conditioner of North-West make Cat No. ACPU6MBT (J/G/K), or its equivalent, complete with starter, 32 Amps "C" series DP, MCB, plug socket with matching plug top, metal box in concealed manner, including necessary connections & earthing (For Spli A.C)	6	No.	1248.00	7488.00
4.29	**Circuit/Submain Wiring in PVC Conduit:**				
	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed medium class PVC conduit as required.				
c	2 X 4 sq. mm + 1 X 4 sq. mm earth wire	100	RM	298.00	29800.00
d	4 X 6 sq. mm + 2 X 6 sq. mm earth wire	10	RM	673.00	6730.00
	TRADE SUMMARY				129670.00
10.00	**AIRCONDITIONING SYSTEM**				
	Note :- Prior to commencement of work, the firm is required to prepare the layout as per the modernisation drawing and submit the same to LICI for approval and the rates are inclusive of the same.				
10.01	Supply, Installing, testing and commissioning of following type of **HIGH WALL SPLIT AIR CONDITIONERS UNITS** having ROTARY compressor and all accessories consisting of high wall mounting type indoor units with remote control and outdoor unit consisting of compressor ,condensor coil ,condensor fan with single phase 240 volt + 10 % or - 10% ac supply ,protection unit for under voltage complete in all respect. The out door unit is to be installed on terrace/outdoor with suitable size of M.S frame, its legs grouted by using cement & sand etc. OR installed on outer wall duly supported with suitable size of MS angle iron frame of balcony Type & channel of adequate capacity, Strong enough to take load of machine and mechanics, including providing anti vibration pads	-			
(c)	**1.5 TR INVERTER SPLIT AC UNITS (5 Star Rated)**	0	Set	44464.00	0.00
(d)	**2.0 TR INVERTER SPLIT AC UNITS (5 Star Rated)**	2	Set	51882.00	103764.00

10.02	**SITC of following Casset split, Invertor AC unit with one indoor and one outdoor units , 5 Star BEE labeled energy efficient AC unit with Rotary type compressor, air deflection system and all accessories complete with LCD remote control unit (including operational batteries) filling of R-32 Refrigeration gas, Control cable between indoor and out door unit & suitable for & suitable for operation on 50 HZ single phase A.C. supply etc. the cost shall be inclusive for neccessary angle support for mounting AC unit, minor modification of Window, neccesary plywood frame work for blocking air leakage. (Rate is inclusive of up to 3mtr length of refrigerant piping for Hi wall split AC.) (CAT no. shall be specified along with Technical literature.) .**				
	Note: All AC units shall have copper condenser coil. Makes for Air conditioners- Voltas/ Carrier/BlueStar/Hitachi.				
	2.0 TR Cassate AC	3	Set	85000.00	255000.00
10.03.a	Supply & installation of 4.0 KVA, single phase Voltage Stabilizer with Hi / Low Voltage cut off & time delay of Voltas / V-guard / Vintek / Blue Bard / Camipro / Logic Star make.	0	Each	3140.00	0.00
b	Supply & installation of 5.0 KVA, single phase Voltage Stabilizer with Hi / Low Voltage cut off & time delay of Voltas / V-guard / Vintek / Blue Bard / Camipro / Logic Star make.	2	Each	4134.00	8268.00
10.04	Providing & fixing following size of Rigid PVC Drain pipe with all accessories etc. complete on wall/ beam/ ceiling in concealed manner by chasing wall/ floor or on surface including providing of U trap to avoid sweating/ condensation specially on false ceiling up to a height of one meter above the plinth protection.				
(a)	25mm dia	100	Rm	93.00	9300.00
10.05	Providing & fixing refrigerant copper pipe of required size with nitrile rubber/Heatlon insulation for following size of A.C. Units with the help of GI sadling on wall or with suitable hangers from the ceiling as the case may be . **(Note:The measurement shall be taken for the refrigerant pipe including the control cable from ODU to IDU and all the three items (suction,preesure & control cable) shall be considered as one run). (The measurement will be taken in running meter excluding 3.0 meter length for split AC).**				
(a)	1.5/2 TR highwall split units	40	Rm	580.00	23200.00
(b)	1.5/ 2.0 TR Cassette AC of 2.0 Ton	80	RM	685.00	54800.00

10.06	SITC OF CABLE FOR AC UNIT :-3 C x 2.5 sq mm PVC insulated copper cable for individual split ac unit from AC sub pannel	50	Rm	111.00	5550.00
	TRADE SUMMARY				**459882.00**
	SUMMARY				
SL. NO.	**DESCRIPTION**				**AMOUNT**
1.00	ELECTRICAL INSTALLATION				129670.00
6.00	**AIRCONDITIONING SYSTEM**				**459882.00**
	TOTAL ESTIMATED COST				**589552.00**

Note :- Qty mentioned above are Provisional, Exact qty of the work shall be determined as per execution as instructed by the engineer during the visit for handing over of site for commencement of work.

Contractor

Chief Engineer

COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT CHARGES (FIXED RATE OF CAMC AFTER DLP OF ONE YEARS)

LIC of India has fixed the following rates for CAMC for five years after DLP of 1 years.. The following **CAMC rates are exclusive of GST,** which willbe reimbursable on submission of proof of payment to the authorities for the subject work. Any Variation in the tax structure as per the prevailing government rules and regulation will be considered and paid /recovered. Please note that the concerned technician assigned for head quarter should attend the Breakdown within 24 hrs. for ZTC Office **and rectification can be completed within the specified time. If fail then a penalty of Rs.200/- per day per AC will be deducted from the bill of the agency. In case, considering quantum of defects, the AC are required to be shifted to agency's workshop for repairing, one serviced AC of adequate capacity has to be provided by the agency.** However in case the service AC is provided as standby before the expiry of stipulated response time, no penalty will be charge

Item No.	Item Description	Unit	Yly. Rate in fig
	Rate for all inclusive comprehensive AMC exclusive of GST for 1.5 TR & 2.0TR Hi wall split AC and 2.0TR Cassate AC systems after completion of warranty / DLP period of ONE -YEAR		
1	1.5TR Hi wall split		
	1st year CAMC	Per Set	4000.00
	2nd year CAMC	Per Set	4200.00
	3rd year CAMC	Per Set	4400.00
	4th year CAMC	Per Set	4600.00
	5th year CAMC	Per Set	4800.00
2	Do- but 2.0TR Hi wall split		
	1st year CAMC	Per Set	4500.00
	2nd year CAMC	Per Set	4700.00
	3rd year CAMC	Per Set	4900.00
	4th year CAMC	Per Set	5100.00
	5th year CAMC	Per Set	5300.00
3	Do- but 2.0 TR Cassette AC		
	1st year CAMC	Per Set	6800.00

	2nd year CAMC	Per Set	7140.00
	3rd year CAMC	Per Set	7500.00
	4th year CAMC	Per Set	7900.00
	5th year CAMC	Per Set	8300.00

NOTE:- **The above rates are exclusive GST. GST will be paid extra as applicable**

CONTRACTOR'S RATES:

B: I/WE AGREE TO CARRYOUT THE WORK

Sr.	Rates to be quoted by the contractor	Total Estimated cost of the work for both SO	Quoted value of the work (on the basis quoted % rate)
a)	At par with the above rates	(Rs.695102.00 + Rs.589552.00) – Total amounting to Rs.1284654.00	Rs.
b)	(-) ----------%(----------percentage) below than the estimated rates		
c)	(+) ----------%(----------percentage) above than the estimated rates		

NOTE:

1. **Amount should be both in figures and words. Percentage above or below quoted at (b) or (c) up to two decimal shall only considered.**

SIGNATURE OF CONTRACTOR

Chief Engineer

PLACE: