THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI)

TENDER DOCUMENTS

FOR

AIR CONDITIONING OF AUDITORIUM AT
THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI),
12, SUDDER STREET,
KOLKATA – 700 016

CONSULTANT
PARTHA DAS & ASSOCIATES
AE – 377, SECTOR-I, SALT LAKE CITY, KOLKATA- 700 064

SECTION – I

GENERAL INSTRUCTIONS

AIR CONDITIONING WORK AT
AUDITORIUM IN THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI),
12, SUDDER STREET, KOLKATA – 700 016

GENERAL INDEX

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THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI)

12, SUDDER STREET, KOLKATA – 700 016

TENDER NOTICE

Sealed tenders are invited of behalf of the Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 in the prescribed form from reputed, bonafide and resourceful contractors for Air Conditioning work at Auditorium of Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016.

Sl. No.	Tender No.	Name of Work	Estimated Cost (Rs.)	Completion time in months	Earnest Money (Rs.)
1.		Air Conditioning work at Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016	27,97,544.00	1	56,000.00

Earnest Money will be accepted in the form of Bank Draft drawn in favour of Institute of Cost Accountants of India payable at Kolkata. No interest will be paid in this amount of earnest money deposited by the tenderer.

Tender papers and other details will be available from 11/04/2013 to 23/04/2013.

{Pre-bid discussion will be held at the office of the Architect, AE-377, Sector – 1, (Ground floor), Salt Lake City, Kolkata 700 064 at 11 a.m. – 3 p.m. on 17/04/2013 for clarification, if any, required for quoting the price by the tenderers.}

Tender will have to be submitted in two parts: Cover-I & Cover-II separately sealed and superscribed with the name of work in the Tender Box of the Institute at 12, Sudder Street, Kolkata – 700 016.

Cover-I shall contain Earnest Money, covering letter and conditions, if any, stipulated by the tenderer together with credentials to establish experience of similar works in the last 5 years.

Cover-II shall contain the complete tender document duly filled and signed with stamp in all pages in duplicate. No condition stipulated in Cover-II other than general rebates shall be accepted.

Tenders in Cover-I & Cover-II shall again be put in a separate sealed cover. This will be received upto 3 p.m. on 24/04/2013. Cover-I will be opened at 4.30 p.m in the office of the Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 on the same date in presence of the contractors or their authorized representatives who may like to be present. Time and date of opening of Cover-II of tender will be intimated thereafter. The Institute of Cost Accountants of India reserves the right to reject any or all of the tenders received without assigning any reason thereof.

The Institute of Cost Accountants of India retains right to cancel any of the items at a later date after the contract is awarded.

INSTRUCTIONS TO TENDERER

1. Sealed Tenders are hereby invited of behalf of the Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 for Air Conditioning work at Auditorium of Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016. Estimated cost of work is Rs. 27,97,544.00 (Rupees twenty seven lakh ninety seven thousand five hundred forty four only.)

2. Contract documents consisting of the plans, complete specifications, the schedule of quantities of the various classes of works to be done, and the set of conditions of contract may be downloaded from the

3. The site for the work is available to the Contractor in its present conditions. No space other than the above site can be made available to the contractor for site office, labour camps, storage etc.

4. Tender to be submitted on the printed form issued by the authority of the Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016

5. Sealed tenders on the prescribed form are to be addressed to the Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 in two separate sealed covers containing the documents as under:

Cover – I	:	Earnest money, valid Income Tax and Sales Tax Clearance Certificates and other stipulation, if any together with credentials to establish experience of similar works in the last 5 years.
Cover – II	:	The priced tender papers along with Conditions of Contract, Technical Specifications (in duplicate). Any condition stipulated in Cover-II (Priced tender paper) will not be accepted.

The Cover I will be opened at about 4.30 P.M. on 24/04/2013 in presence of tenderers. The tenderers shall depute their authorised representative/s to be present at the time of opening. Tender without earnest money in proper form will be rejected.

The Cover II : Time and date of opening of Cover-II of tender will be intimated after opening Cover I.

6. The time allowed for commencement of the work will be within fourteen days after date of written orders.

7. The contractors should quote in figures as well as in words the rate, and amount tendered by them. The amount for each item should be worked out and the total amount for sub section shall be given.

8. All corrections shall be attested by the initials of the tenderers with the seal of the firm. In case any discrepancy/difference is found on checking between rates quoted by the contractor in words and figures or in the amount worked out by him, the following procedure shall be followed:

   a) The rates quoted in words is final and the corresponding amount will be considered for evaluation.
   b) The decision of the Institute of Cost Accountants of India in resolving any ambiguity regarding the rates quoted will be final.
   c) Amendments as mentioned above shall be based on the tender marked “original” only.

9. All writing should be in English and legible.

10. Earnest money, amounting to Rs. 56,000.00 in the form of Bank Draft drawn in favour of Institute of Cost Accountants of India payable at Kolkata. No interest will be paid in this amount of earnest money deposited by the tenderer.

11. The acceptance of a tender will rest with the competent authority of Institute of Cost Accountants of India who does not bind themselves to accept the lowest tender, and reserves to themselves the authority to reject any or all of the tenders received without the assignment of a reason. All tenders in which any of the prescribed conditions are not fulfilled or are incomplete in any respect are liable to be rejected.

The Owner reserves the right to accept the tender in full or in part and the tenderer shall have no claim for revision of rates or other conditions if his tender is accepted in parts.

12. Canvassing in connection with tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.

13. **Deleted**

14. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Owner/Consultant shall be communicated to the Employer.

15. Special care should be taken to write the rates in figures as well as in words and the amounts in figures only. The total amount should be written both in figures and in words. In case of figures, the words 'Rs.' should be written before the figure of rupees and words 'P' after the decimal figures.

16. The owner does not bind itself to accept the lowest or any tender and reserves to itself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rate quoted.

17. Sales tax or any other tax on material or on finished works like work's contract tax, Turnover Tax, etc. in respect of this contract shall be payable by the contractor and the owner will not entertain any claim whatsoever in this respect. All taxes, duties, cess etc. should be included in their rates. Any tax, cess etc. levied during the pendency of the contract, the same shall be borne by the contractor and no claim whatsoever in this regard will be entertained. **Service tax shall be paid separately by the Owner as per prevailing norms during the payment.**

18. **Deleted**

19. The tender for works shall remain open for acceptance for a period of 90 days from the date of opening of tenders. If any tenderer withdraws his tender before the said period, then the owner shall be at liberty to forfeit Earnest Money paid along with the tender.

20. It will be obligatory on the part of the tenderer to tender and sign the tender documents in totality and the successful tenderer will have to enter into an agreement for the tendered work with the competent authority.

21. The appointed contractor must co-operate with other agencies appointed by the owner who will be working at the same site for different work for timely completion of the work.

22. The notification of award of contract will be made in writing to the successful tenderer by the owner.

Convener, Purchase Committee

_____

For Institute of Cost Accountants of India

FORM OF TENDER (To be filled up by the Tenderer)

To,
The Institute of Cost Accountants of India,
12, Sudder Street,
Kolkata – 700 016

Dear Sir,

Re.: Air Conditioning work at Auditorium in Institute of Cost Accountants of India,
12, Sudder Street, Kolkata – 700 016

1. I/We refer to the tender notice issued by the Institute of Cost Accountants of India in connection with the above.
2, I/We do hereby offer to perform, provide, execute, complete and maintain the works in conformity with the drawings, conditions of contract, specifications, bill of quantities for the sum of Rs. 2797544.00 at the respective rates quoted in the bill of quantities.
3. I/We have satisfied myself/ourselves as to the site conditions, examined the drawings and all aspects of the tender conditions, subject to above, I/We do hereby agree & quote accordingly.
   a) Abide by and fulfil all the terms and provisions of the said conditions annexed hereto;
   b) Complete the works within the stipulated time as per the tender provision in two or three shifts if considered necessary by the Employer/Consultant at no extra cost to the Employer.
4. I/We have deposited the earnest money of Rs. 56,000 (Rupees fifty six thousand only) in the form of Bank Draft, I/we note, will not bear any interest and is liable for forfeiture:

   i) If our offer is withdrawn within the validity period of acceptance.
   or
   ii) If the Contract is not executed within 15 days from the date of receipt of the letter of acceptance.
   or
   iii) If the work is not commenced within 14 days after issue of work order.
5. I/We understand that you are not bound to accept the lowest or any tender you receive.
6. Name of Partners/Directors of our Firm:
   i)
   ii)
   iii)

Yours faithfully

Signature _____

Designation _____

Name of Partner/Director of the firm authorised to sign or Name of person having power of attorney to sign the contract, (Certified true copy of the power of attorney should be attached)

Signature and address of witness :

a) Signature _____
Name _____
Address _____

b) Signature _____
Name _____
Address _____

DRAFT ARTICLES OF AGREEMENT

ARTICLES OF AGREEMENT made the __ day of _____ Two Thousand and _____between the Institute of Cost Accountants of Indi , having its Office at Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 (hereinafter called "the Owner") of the one part and _____ (hereinafter called "the Contractor") of the other part.

WHEREAS the Owner is desirous of executing the Air Conditioning work at Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 and has caused drawings and specifications describing the works to be prepared by M/s. Partha Das & Associates, AE-377, Sector-I, Salt Lake City, Kolkata – 700 064 .

AND WHEREAS the said DRAWINGS numbered _____ to the Specifications and the Schedule of items and quantities have been signed by and on behalf of the parties hereto.

AND WHEREAS the contractor has agreed to execute upon and subject to the conditions set forth herein and Schedule of Items and quantities, General Conditions of Contract, specifications and all correspondences exchanged by or between the parties from the submission of tender till the award of work, both letters inclusive, (all of which are collectively hereinafter referred to as 'the said conditions) the works shown upon the said drawings and/or described in the said specification and included in the schedule of items and quantities at the respective rates therein set forth amounting to the sum as therein arrived at or such other sum as shall become payable thereunder (hereinafter referred to as ""he said contract amount").

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the said contract amount to be paid at the times in the manner set forth in the said conditions, the contractor shall upon and subject to the said conditions execute and complete the work shown upon the said drawings and described in the said specifications and the schedule of items and quantities.

2. The Owner shall pay the contractor the said contract amount, or such other sum as shall become payable, at the times and in the manner specified in the said conditions.

3. The project Consultant in the said conditions shall mean the said M/s. Partha Das & Associates, AE-377, Sector-I, Salt Lake City, Kolkata – 700 064 or, in the event of their ceasing to be the Consultant for the purpose of this contract for whatever reason, such other person or persons as shall be nominated for that purpose by the Owner, provided always that no person subsequently appointed to be Consultant under this contract shall be entitled to disregard or over rule any previous decision or approval or direction given or expressed in writing by the Consultant for any time being.

4. The said conditions and Appendices thereto shall be read and considered as forming part of this Agreement, and the parties hereto shall respectively abide by, submit themselves to the said conditions and perform the agreements on their part respectively in the said conditions contained.

5. The plans, agreements and documents mentioned herein shall form the basis of this contract.

6. This contract is neither a fixed Lump Sum contract nor a piece work contract but is a contract to carry out the work in respect of the Air Conditioning work at Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 as per the scope described and to be paid for according to actual measured quantities at the rates contained in the Schedule of Rates and Probable quantities or as provided in the said conditions.

7. The Owner reserves to itself the right of altering the drawings and nature of the work by adding to or omitting any items of work or having portions of the same carried out without prejudice to this contract.

8. Time shall be considered as the essence of this contract and the contractor hereby agrees to commence the work on the day on which he is instructed to take possession of the site or from fourteenth day after the date of issue of formal work order as provided for in the said conditions whichever is later and to complete the entire work within 1 month subject nevertheless to the provisions for extension of time.

9. All payments by the Owner under this contract will be made only at Kolkata.

10. Any dispute arising under this Agreement shall be referred to arbitration in accordance with the stipulation laid down in the general conditions of contract.

11. That the several parts of this contract have been read by the contractor and fully understood by the contractor.

IN WITNESS WHEREOF the Owner and the Contractor has set their respective hands to these presents and two duplicates hereof the day and year first herein above written.

If the contractor is a Partnership or an Individual.

IN WITNESS WHEREOF the Owner has set Its hands to these presents through its duly authorised official and the contractor has caused its common seal to be affixed hereunto and the said two duplicates/has caused these presents and the said two duplicate hereof to be executed on its behalf, the day and year first hereinabove written.

If the Contractor is a Company.

Signature clause:

SIGNED AND DELIVERED
by the hand of Shri _____
(Name and Designation)
In the presence of

(1) _____
Address _____

(2) _____
Address _____

Witness

SIGNED AND DELIVERED BY _____
_____
in the presence of

If the party is a partnership firm or an individual should be signed by all or on behalf of all the partners.

(1) _____
Address _____

(2) _____
Address _____

Witness

The COMMON SEAL OF _____
Was hereinto affixed pursuant to the resolutions passed by Its Board of Directors at the meeting held on

If the contractor signs under its common seal, the signature clause should tally with the sealings clause in the Articles of Association

(1) _____

(2) _____

Directors who have signed this presence in token thereof in the presence of

If the contractor is signed by the hand of power of attorney whether a company or individual.

(1) _____

(2) _____

CONDITIONS OF CONTRACT

Except where provided for in the description of the individual items in the schedule of quantities and in the specifications and conditions laid down hereinafter and in the Drawings, the work shall be carried out as per standard specifications and under the direction of Owner/Consultant.

1. INTERPRETATION

In construing these conditions, the specifications the schedule of quantities, tender and Agreement, the following words shall have the meaning herein assigned to them except where the subject context otherwise requires:

i) "Owner"/ "Employer" / : Shall mean competent authority of Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 and shall include their assignees and successors and administrators

ii) Architect / Consultant : The terms Architect / Consultant shall mean M/s Partha Das & Associates, AE-377, Sector-I, Salt Lake City, Kolkata – 700 064 or in the event of their ceasing to be the Consultant for the purpose of this contract such other person/s as the Owner shall nominate for the purpose.

iii) "Contractor": Shall mean Messrs _____ and shall include their assignees and/or successors his/their heirs and administrators.

iv) Site : The site shall mean the site where the works are to be executed as shown within boundary in border on the site plan including any building and erections thereon allotted by the Owner for the contractor's use.

v) "The Contract" : This Contract shall mean the Tender Notices, Instructions to tenders, Conditions of Contract, Special Conditions of Contract, Safety Code, Form of Tender, Technical Specifications, Schedule of Quantities to be supplied by the University, the specification, schedule of quantities and rates and the drawings attached hereto and signed.

vi) "Notice in Writing" : Or written notice shall mean a notices in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known 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.

vii) "Act of Insolvency" shall mean any act as such as defined by the Presidency Towns Insolvency Act, 1909 or in Provincial Insolvency Act, 1920 or any amendments of the said Acts.

viii) Drawings : The work is to be carried out in accordance with drawings, specifications, the schedule of quantities. A set of drawings is provided with the tender to give the general idea about the total construction.
All drawings relating work given to the contractor together with a copy of schedule of quantities are to be kept at site and the Owner/Consultant shall be given access to such drawings or schedule of quantities whenever necessary.
In case any detailed Drawings are necessary contractor shall prepare such detailed drawings and/or dimensional sketches there or and have it conformed by the Owner/Consultant prior to taking up such work.

ix) "The Schedule of Quantities" shall mean the schedule of quantities as specified and forming part of this contract.

x) "Priced Schedule of Quantities" shall means the schedule of quantities duly priced with the accepted quoted rates of the contractor.

2. SCOPE

The work consists of Air Conditioning work at Auditorium in Institute of Cost Accountants of India , 12, Sudder Street, Kolkata – 700 016 in accordance with the 'drawings' and 'schedule of quantities". The General Building, works are within the scope of this tender. It includes furnishing all materials, labour, tools and equipment and management necessary for the incidental to the construction and completion of the work. All works, during its progress and upon completion, shall conform to the lines, elevations and grades as shown on the drawings furnished by the Owner/Consultant. Should any detail essential for efficient completion of the work be omitted from the drawings and specifications it shall be the responsibility of the contractor to inform the Owner/Consultant and to furnish and install such detail with Owner's/Consultant's concurrence, so that upon completion of the proposed work the same will be acceptable and ready for use.

Owner/Consultant may in their absolute discretion issue further drawings and/or written instructions, details, directions and explanations, which are, hereafter collectively referred to as "The Owner's/Consultant's instructions" in regard to :

a) The variation or modification of the design quality or quantity 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 specification.
c) The removal from the site of any defective material brought thereon by the contractor and the substitution of any other material thereof.
d) The demolition removal and/or re-execution of any work executed by the contractor/s**.**
e) The dismissal from the work of any persons employed thereupon.
f) The opening up for inspection of any work covered up.
g) The rectification and making good of any defects under clauses hereinafter mentioned and those arising during the maintenance period (retention period).

The contractor shall forthwith comply with and duly execute any work comprised in such Owner's/Consultant' instructions, provided always that verbal instructions, directions and explanations given to the contractor's or his representative upon the works by the Owner/Consultant shall if involving a variation be confirmed in writing to the contractor/s within seven days. No work for which rates are not specifically mentioned in the priced schedule of quantities, shall be taken up without written permission of the Owner/Consultant. Rates of items not mentioned in the priced schedule of quantities shall be fixed by the Owner in consultation with the Consultant.

The contractor shall set up a field laboratory with necessary equipments for day to day testing of materials like grading of coarse and fine aggregates, silt content and bulkage of sand crushing strength of concrete etc.

Regarding all factory made products for which ISI marked products are available, only products bearing ISI marking shall be used in the work. Other products should be supplied as per the brand name mentioned in the Technical Specifications.

3. DETAILED DRAWINGS AND INSTRUCTIONS

The Owner through its Consultant shall furnish with reasonable promptness additional instructions by means of drawings or otherwise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom.

The work shall be executed in conformity therewith and the contractor shall not work without proper drawings and instructions.

Immediately after receipt of the work order of the contract the contractor shall prepare a progress schedule and submit the same to the Owner through the Consultant for approval which shall indicate the dates for the starting and completion of the various stages of constructions.

4. COPIES FURNISHED

The Contractor on the signing hereof shall be furnished by the Owner through its Consultant free of charge with a copy of the priced schedule of quantities/rates, two copies of each of the said drawings and one copy of specifications and two copies of all further drawings issued during the progress of the work. Any further copies of such drawings required by the Contractor shall be supplied on payment of charges thereof by the Contractor.

5. OWNERSHIP OF DRAWING

All drawings, specifications and copies thereof furnished by the Owner through its Consultant are the property of the Owner. They are not to be used on other work, and with the exception of signed contract set, are to be returned to the Owner on request at the completion of the work.

6. ROYALTIES AND PATENTS

The contractor shall pay all royalties and licence fees. He shall defend all suits for claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

7. Deleted

8. SUPERINTENDENCE SUPERVISION

The Contractor shall give all necessary personal Superintendence during the execution of the work and this obligation and liability will continue until expiration of the 'Maintenance Period' (Retention Period). The contractor shall also during the whole time of work when in progress employ a competent representative who shall be constantly in attention at the site while his men are at work. Any directions, explanations, instructions or notices given by the Owner or the Consultant to such representative shall be deemed to have been given and duly served on the contractor.

9. FAILURE BY CONTRACTORS TO COMPLY WITH OWNER'S/CONSULTANT' INSTRUCTIONS

If the contractor after receipt of written notice from the Owner and/or the Consultant requiring compliance within ten days fails to comply with such further drawings and/or Owner's/Consultant's instructions, the Owner through the Consultant or other person, may employ other person to execute any such work whatsoever that may be necessary to given effect thereto and pay all cost incurred in connection therewith and same shall be recoverable from the contractor by the Owner on the certificate of the Consultant as a debt or shall have right to deduct same from any moneys due or to become due to the contractor.

10. TENDERER SHALL VISIT THE SITE

Intending tenderer shall visit the site and make himself thoroughly acquainted with the local site condition, nature and requirements of the works, facilities of transport condition, effective labour and materials, access and storage for materials and removal of rubbish. The tenderer shall provide in their tender for cost of carriage, freight and other charges as also for any special difficulties and including police restriction for transport etc. for proper execution of work as indicated in the drawings. The successful tenderer will not be entitled to any claim of compensation for difficulties faced or losses incurred on account of any site condition which existed before the commencement of the work or which in the opinion of the Owner/Consultant might be deemed to have reasonably been inferred to be so existing before commencement of work.

11. TENDERS

The entire set of tender paper issued to the tenderer should be submitted fully priced and also signed on the all pages. Initial/signature will indicate the acceptance of the tender papers by the tenderer.

The schedule of quantities shall be filled in as follows:

The tendered amount is to be quoted as percentage above or below the estimated amount

i) When there is difference between the rates in figures and in words, the rate quoted in words prevail.

No modifications, writings or corrections can be made in the tender papers by the tenderer, but may at his option offer his comments or modifications to be given in Cover-I.

The Owner reserves the right to reject the lowest or any tender and also to discharge any or all the tenders for each section or to split up and distribute any item of work to any specialist firm or firms, without assigning any reason.

The works will be paid for as "measured work" on the basis of actual work done.

All items of work described in the schedule of quantities are to be deemed and paid as complete works in all respects and details including preparatory and finishing works involved, directly, related to and reasonably

detectable from the drawings, specifications and schedule of quantities and no further extra charges will be allowed in this connection. In the case of lump sum charges in the tender in respect of any item of works, the payment of such items of work will be made for the actual work done on the basis of lump sum charges as will be assessed to be payable by the Owner/Consultant.
The Owner has power to add to omit from any work as shown in drawings or described in specifications or included in schedule of quantities and intimate the same in writing but no addition, omission or variation shall be made by the contractor without authorisation from the Owner. No variation shall vitiate the contract. The quantity of any item may vary to any extent based on the actual design & site condition. In such cases the rate for the respective items shall remain valid and the contractor has to execute as per instruction.

The tenderer shall note that his tender shall remain open for consideration for a period of ____days from the date of opening of the tender.

12. TIME AND PROGRESS CHART

The contractor shall within 15 (fifteen) days of receipt of intimation that his tender has been accepted, submit to the Consultant/Owner a detailed programme of work so drawn as would enable him to complete the work within the time contemplated. The detailed work programme must indicate dates of starting and completion of respective parts or sections of the work. The detailed work programme would be subjected to the approval of the Owner/Consultant who will have the power of making such modification thereon as found necessary. The actual progress as compared with this chart will be reviewed periodically.
The contractors shall have to prepare their own material in flow according to the final Programme as accepted by Owner. The programme shall have to be updated at regular intervals and modified programme shall be submitted to the Consultant/Owner for approval. In no case the overall date for the completion of important items as indicated in the programme should be changed without prior consent of Consultant/Owner.

13. CO-OPERATION

The contractor will be required to consult and co-operate with other contractors whose work may be affected by the work under this contract.

14. TREASURE TROVE ETC.

Any treasure trove, coin or object antique which may be found on the site shall be the property of the Owner and shall be handed over to the Owner.

15. PERMITS AND LICENCES

Permits and licences for release of materials which are under Government control will be arranged by the contractor. The Owner will render necessary assistance, sign any forms or applications that may be necessary.

16. GOVERNMENT AND LOCAL RULES

The contractor shall conform to the provisions of all local Bye-laws and Acts relating to the work and to the Regulations etc. of the Government and Local Authorities and of any company with whose system the structure is proposed to be connected. The contractor shall give all notices required by said Act, Rules, Regulations and Bye-Laws etc. and pay all fees payable to such authority/authorities for execution of the work involved. The cost, if any, shall be deemed to have been included in his quoted rates, taking into account all liabilities for licences, fees for footpath encroachment and restoration etc. and shall indemnify the Owner against such liabilities and shall defend all actions arising from such claims or liabilities.

17. TAXES AND DUTIES

The tenderers must include in their tender prices quoted for all duties, royalties, cess and sales tax or any other taxes or local charges if applicable. The rates shall also include prevailing sales tax on works contract as per State Government norms. All taxes, duties, cess etc. should be included in their rates. Any tax, cess etc. levied during the pendency of the contract, the same shall be borne by the contractor and no claim whatsoever in this regard will be entertained. Service tax shall be paid by the Owner as per prevailing norms during payment of their bills.

No extra claim on this account will in any case be entertained.

18. POSSSESSION PRIOR TO COMPLETION

The Owner shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be an acceptance of any work not completed in accordance with the contract Agreement.

19. PROVISIONAL SUMS (P S)

All provisional sums described in the schedule of quantities as P S shall be exclusively allotted to the purchase of materials and not for any handling and fixing to be done by the contractor. Such costs of handling and fixing with profit (including transport charges if required) shall be separately included in the contract price as described in the schedule of quantities. The disposal of the amounts covered under this head will be absolutely at the discretion of the Owner. Contractor is to make payments for these materials to the suppliers on certificate or order issued by the Owner/Consultant and realise them through his bills from the Owner.

20 QUANTITY OF WORK TO BE EXECUTED

The quantities shown in the schedule of quantities are intended to cover the entire new structure indicated in the drawings but the Owner reserves the right to execute only a part or the whole or any excess thereof without assigning any reason therefor.

21. OTHER PERSONS ENGAGED BY THE OWNER

The Owner reserves the right to execute any part of the work included in this contract or any work which is not included in the contract by other Agency or persons and contractor shall allow all reasonable facilities and use of his scaffolding for the execution of such work. The main contractor shall extend all cooperation in this regard.

22. RETENTION MONEY AND SECURITY DEPOSIT

An amount of 10% (including Earnest Money Deposit) of the gross value of each R.A. Bill of the contractor will be deducted as Retention Money. 50% of the Retention Money so deducted will be refunded after virtual completion of work, along with a certification of the Consultant and rest 50% will be refunded after expiry of Defect Liability Period provided that the contractor has satisfactorily carried out all the works, submitted all documents contractually called for and attended to all defects in accordance with the Conditions of Contract and also along with a certification of the Consultant. No interest is allowed on Retention Money.

23. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY

The contractor shall provide everything necessary for the proper execution of the work according to the intent and meaning of the drawings, schedule of quantities and specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred therefrom and if the contractor finds any discrepancies therein he shall immediately and in writing, refer the same to the Owner/Consultant whose decision shall be final and binding. The contractor shall provide himself for ground and fresh water for carrying out of the works at his own cost. The Owner shall on no account be responsible for the expenses incurred by the contractor for hired ground or fresh water obtained from elsewhere.

The rates quoted against individual items will be inclusive of everything necessary to complete the said items of work within the contemplation of the contract, and beyond the unit price no extra payment will be allowed for incidental or contingent work, labour and/or materials inclusive of all taxes and duties whatsoever except for specific items, if any, stipulated in the tender documents.

The contractor shall supply, fix and maintain at his own cost, for the execution of any work, all tools, tackles, machineries and equipments and 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 safety of any adjacent roads, streets, walls, houses, buildings, all other erections, matters and things and the contractor shall take down and remove any or all such centering, scaffolding, planking, timbering, strutting, shoring etc. as occasion shall be required or when ordered so to do and shall fully reinstate and make good all matters and things disturbed during the execution of works to the satisfaction of the Owner/Consultant.

The contractor shall also provide such temporary road on the site as may be necessary for the proper performance of the contract, and for his own convenience but not otherwise. Upon completion, such roads shall be broken up and levelled where so required by the drawings unless the Owner shall otherwise direct.

The contractor shall at all times give access to workers employed by the Owner or any men employed on the buildings and to provide such parties with proper sufficient and if required, special scaffolding, hoists and ladders and provide them with water and lighting and leave or make any holes, grooves etc. in any work, where directed by the Owner as may be required to enable such workmen to lay or fix pipes, electrical wiring, special fittings etc. The quoted rates of the tenderers shall accordingly include all these above mentioned contingent works.

24. TIME OF COMPLETION EXTENSION OF TIME AND PROGRESS CHART

24.1 Time of Completion : The entire work is to be completed in all respects within the stipulated period. The work shall deemed to be commenced within 1 month from the date of acceptance letter or date of handing over of site, whichever is earlier. Time is the essence of the contract and shall be strictly observed by the contractor.

The work shall not be considered as complete until the Owner/Consultant have certified in writing that this has been completed and the Defects Liability Period shall commence from the date of such certificate.

24.2 Extension of Time: If in the opinion of the Owner/Consultant the works be delayed (a) by reason of any exceptionally inclement weather, or (b) by reason of instructions from the Owner in consequence of proceedings taken or threatened by or disputes, with adjoining or neighbouring owners or (c) by the works, or delay of other contractors or tradesmen engaged or nominated by the Owner and not referred to in the specification or (d) by reason of authorised extra and additions or (e) by reason of any combination of workmen or strikes or lockout affecting any of the building or trades or (f) from other causes which the Owner may consider are beyond the control of the contractor, the Owner at the completion of the time allowed for the contract shall make fair and reasonable extension of time for completion in respect therefor. In the event of the Owner failing to give possession of the site upon the day specified above the time of completion shall be extended suitably.

In case of such strikes or lockouts, as are referred to above, the contractor shall, immediately give the Owner, written notice thereof. Nevertheless, the contractor shall use his best endeavours to prevent delay and shall do all that may be reasonably required, to the satisfaction of the Owner to proceed with the works and on his doing so that it will be ground of consideration by the Owner for an extension of time as above provided. The decision of the Owner as to the period to be allowed for an extension of time for completion hereunder (which decision shall be final and binding on the contractor) shall be promulgated at the conclusion of such strike or lockout and the Owner shall then, in the event of an extension being granted, determine and declare the final completion date. The provision in clause 62 with respect to payment of liquidated damages shall, in such case, be read and construed as if the extended date fixed by the Owner were substituted for and the damage shall be deducted accordingly. The proper evidences/supporting papers/written instruction for any such hindrances shall be maintained by the contractor with due information to the owner/consultant instantly.

24.3 Progress of Work: During the period of construction the contractor shall maintain proportionate progress on the basis of a Programme Chart submitted by the contractor immediately before commencement of work and agreed to by the Owner/Consultant. Contractor should also include planning for procurement of scarce material well in advance and reflect the same in the Programme Chart so that there is no delay in completion of the project.

25. TOOLS, STORAGE OF MATERIALS, PROTECTIVE WORKS AND SITE OFFICE REQUIREMENTS

The contractor shall provide, fix up and maintain in an approved position proper office accommodation for the contractor'' representative and staff which offices shall be open at all reasonable hours to receive instruction notices or communications and clear away on completion of the works and make good all work disturbed.

All drawings maintained on the site are to be carefully mounted on boards of appropriate size and covered with a coat of approved varnish. They are to be protected from ravages of termites, ants, and other insects.

The contractor shall provide at his own cost all artificial light required for the work and to enable other contractors and sub-contractors to complete the work within the specified time. The contractor shall provide a suitable temporary hut for the watchmen and clear away the same when no longer required and to provide all necessary attendance, lights etc. required.

The contractor shall arrange for temporary latrines for the use of workers and field staff and keep the same in a clean and sanitary condition to the satisfaction of the Public Health Authorities and shall cause such latrines and soil to be cleared away whenever necessary and shall make good all the works disturbed by these convenience.

Every precaution shall be taken by the contractor to prevent the breeding of mosquitoes on the works during the construction, and all receptacles, cistern, water tanks etc. used for the storage of water must be suitably protected

against breeding of mosquitoes. The contractor shall indemnify the Owner against any breach of rules in respect of anti-malarial measures

The contractor shall not fix or place any placards or advertisement of any description or permit the same to be fixed or placed or upon any boarding gantry, building structure other than those approved by the Owner.

Protective Measures: The contractor from time to time of being placed in possession of the site must make suitable arrangement for watching, lighting and protecting the work, the site and surrounding property by day, by night, on Sundays and other holidays.

Contractor shall indemnify the Owner against any possible damage to the building, roads, or members of the public in course of execution of the work.

The contractor shall provide necessary temporary enclosures, gates, entrances etc. for the protection of the work and material and for altering and adopting the same as may be required and removing on completion of the works and making good all works disturbed.

Storage of Materials: The contractor shall provide and maintain proper sheds for the proper storage and adequate protection of materials etc. and other work that may be executed on the site including the tools and materials of nominated sub-contractors and remove the same on completion.

Cement godown shall be constructed for storing about six weeks requirement of cement and stored as per norms with a stack of 10 bags each and 2 feet opening alround with 2 feet passage of each stack. Structure shall be waterproof from all the sides and top. Cement should be stored one feet above the ground level and have pucca raised floor.

So also reinforcement bars are to be stored above the ground level to prevent the same from getting rusted.

Tools: Theodolite, levels, prismatic compass, chain, steel and metallic tapes and all other surveying instruments found necessary on the works shall be provided by the contractor for the due performance of this contract as instructed by the Site Engineer.

All measuring tapes shall be of steel and suitable scaffolding and ladders that may be required for safely taking measurement and shall be supplied by the contractor.

The mistries and the supervisors on the works shall carry with them always a one metre or two metres steel tape, a measuring tape of 30 metres, a spirit level, a plumb bob and a square and shall check the work to see that the work is being done according to the drawing and specifications. The Site Engineer will use any or all measuring instruments, or tools belonging to the contractors as he chooses for checking the works executed or being executed on the contract.

The contractor should cover in his rates for making provisions for all reasonable facilities for the use of his scaffolding, tools and plant etc. by nominated sub-contractors for their work.

26. NOTICE AND PATENTS OF APPROPRIATE AUTHORITY AND OWNER

The contractor shall conform to the provisions of any Acts of the Legislature relating to the work, and to the Regulations and Bye-laws of any authorities, and/or any water, lighting and other companies, and/or authorities with whose systems the structures were proposed to have connection and shall before making any variations from the drawings or specification that may be associated to so conform, give the Owner/Consultant written notices specifying the variation proposed to be made and the reasons for making them and apply for instruction thereon. The Owner/Consultant on receipt of such intimation shall give a decision within a reasonable time.

The contractor/s shall arrange to give all notices required for by the said Acts, Regulations or Bye-laws to be given to any authority and to pay to such authority or to any public officer all fees that may be properly chargeable in respect of the work and lodge the receipts with the Owner.

The contractor shall indemnify the Owner against all claims in respect of patent rights, royalties, damages to buildings, roads or members of public in course of execution of work and shall defend all actions arising from such claims and shall keep the Owner saved harmless and indemnified in all respects from such actions, coasts and expenses.

27. CLEARING SITE AND SETTING OUT WORKS

The site shown on the plan shall be cleared of all obstructions, loose stone, and materials rubbish of all kinds. All holes or hollows whether or originally existing or produced by removal or loose stone or materials shall be carefully filled up with earth well rammed and levelled off as directed at his own cost. The expenditure incurred for making the site ready for taking up the work has to be borne by the contractor.

The contractor shall set out the works and shall be responsible for the true and perfect setting out of the work and for the correctness 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 irrespective of the fact that the layout had bee approved by the Owner/Consultant, the contractor shall at his own expenses rectify such error, if called upon to the satisfaction of the Owner. The contractor shall further set out the works to the alternative positions at the site until one is finally approved and the rates quoted in his tender should include for this and no extra on this account will be entertained.

28. DATUM

The average ground level will be considered as the crown of the nearest road, which should taken as "Datum" which is however, subject to final confirmation by the Owner/Consultant. All levels shown in the drawings are to be strictly adhered to.

29. Deleted

30. CONTRACTOR IMMEDIATELY TO REMOVE ALL OFFENSIVE MATTERS

All soil, filth or other matters of any 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 place provided by him.

The contractor shall keep the foundations and works free from water and shall provide and maintain at his own expenses electrically or other power driven pumps and other plants to the satisfaction of the Owner for the purpose, until the building is handed over to the Owner. The contractor shall arrange for the disposal of the water so accumulated to the satisfaction of the Owner and local authority and no claims will be entertained afterwards if he does not include in his rates for the purpose.

31. ACCESS

Any authorised representative of the Owner shall at all reasonable times have free access to the works and/or to the workshops, factories or other places where materials are being prepared or constructed for the work and also to any place where the materials are lying or from where they are being obtained, and the contractor shall give every facility to the Owner or their representatives necessary for inspection and examination and test of the materials and workmanship. Except the representatives of the Owner no person shall be allowed at any time without the written permission of the Owner.

32. MATERIALS, WORKMANSHIP, SAMPLES, TESTING OF MATERIALS

All the works specified and provided for in the specifications or which may be required to be done in order to perform and complete any part thereof shall be executed in the best and most workmanlike manner with materials of the best and approved quality of the respective kinds in accordance with the particulars contained in an implied by the specifications and as represented by the drawings or according to such other additional particulars, and instructions as may from time to time be given by the Owner/Consultant during the execution of the work, and to his entire satisfaction.

If required by the Owner/Consultant the contractor shall have to carry out tests on materials and workmanship in approved materials testing laboratories or as prescribed by the Owner/Consultant at his own cost to prove that the materials etc. under test conform to the relevant I.S. Standards or as specified in the specifications. The necessary charges for preparation of mould (in case of concrete cube) transporting, testing etc. shall have to be borne by the contractor. No extra payment on this account should in any case be entertained.

All the materials (except where otherwise described) stores and equipment required for the full performance of the work under the contract must be provided through normal channels and must include charge for import duties, sales tax, octroi and other charges and must be the best of their kind available and the contractor/s must be entirely responsible for the proper and efficient carrying out of the work. The work must done in the best workmanlike

manner. Samples of all materials to be used must be submitted to the Owner/Consultant when so directed by the Owner/Consultant and written approval from Owner/Consultant must be obtained prior to placement of order.

During the inclement weather the contractor shall suspend concreting and plastering for such time as the Owner/Consultant may direct and shall protect from injury all work when in course of execution. Any damage (during constructions) to any part of the work for any reasons due to rain, storm, or neglect of contractor shall be rectified by the contractor in an approved manner at no extra cost.

Should the work be suspended by reason of rain, strike, lockouts or any other cause, the contractor shall take all precautions necessary for the protection of work and at his own expenses shall make good any damage arising from any of these causes.

The contractor shall cover up and protect from damage, from any cause, all new work and supply all temporary/doors, protection to windows, and any other requisite protection for the execution of the work whether by himself or special tradesmen or nominated sub-contractor and any damage caused must be made good by the contractor at his own expenses.

33. REMOVAL OF IMPROPER WORK

The Owner 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 times as may be specified in the order of any materials which in the opinion of the Owner/Consultant are not in accordance with specification or instructions, the substitution or proper re-execution of any work executed with materials or workmanship not in accordance with the drawings and specifications or instruction. In case the contractor refuses to comply with the order, the Owner shall have the power to employ and pay other agencies to carry out the work and all expenses consequent thereon or incidental thereto as certified by the Owner/Consultant shall be borne by the contractor or may be deducted from any money due to or that may become due to the contractor. No certificate which may be given by the Consultant shall relieve the contractor from his liability in respect of unsound work or bad materials.

34. SITE ENGINEER

The term “Site Engineer” shall mean the representative of the consultant who shall remain present at site during the progress of work in order to advise the contractor in all technical matters & issue written instructions with information to the owner. The contractor shall provide the Site Engineer every facility and assistance for examining the works and materials and for checking and measuring work and materials.

The Site Engineer shall have power to give notice to the contractor or his foreman, of non-approval of any work or materials and such work shall be suspended or the use of such materials shall be discontinued until the decision of the Owner is obtained. The work will from time to time be examined by the Consultant, Engineer of the Owner and the Site Engineer. But such examination shall not in any way exonerate the contractor from the obligation to remedy any defects which may be found to exist at any stage of the work or after the same is complete. Subject to the limitations of this clause the contractor shall take instructions only from the Consultant/Owner.

35. OFFICE ACCOMMODATION FOR THE SITE ENGINEER

The contractor shall provide, erect, and maintain at his cost a separate simple watertight office accommodation for the Site Engineer. This accommodation shall be well lighted and ventilated and provided with windows, door with a lock. The Site Engineer’s office shall be a minimum of 150 sq.ft. and the contractor shall provide a desk, chairs, drawers for keeping drawings, a cupboard having proper lock and a tackboard for displaying drawings. The accommodation shall be demolished when directed.

36. CONTRACTOR’S EMPLOYEES

The contractor shall employ technically qualified and competent supervisors for the work who shall be available (by turn) throughout the working hours to receive and comply with instructions of the Owner/Consultant. The contractor shall engage at least one experienced Engineer as Site Engineer for execution of the work. The contractor shall employ in connection with the work persons having the appropriate skill or ability to perform their job efficiently.

The contractor shall employ local labourers on the work as far as possible.

The employment of labour by the contractor shall be as per the prevailing labour laws.

Any labourer supplied by the contractor to be engaged on the work on day work basis either wholly or partly under the direct order or control of the Owner or his representative shall be deemed to be a person employed by the contractor.

The contractor shall comply with the provisions of all labour legislation including the requirements of :

a) The Payment of Wages Act.
b) Owner's Liability Act.
c) Workmen's Compensation Act.
d) Contract Labour (Regulation & Abolition) Act, 1970 and Central Rules 1971.
e) Apprentices Act 1961.
f) Any other Act or enactment relating thereto and rules framed thereunder from time to time.

The contractor shall keep the Owner saved harmless and indemnified against claims if any of the workmen and all costs and expenses as may be incurred by the Owner in connection with any claim that may be made by any workmen.

The contractor shall comply at his own cost with the order of requirement of any Health Officer of the State or any local authority or of the Owner regarding the maintenance of proper environmental sanitation of the area where the contractor's labourers are housed or accommodated, for the prevention of small pox, cholera, plague, typhoid, malaria and other contagious diseases. The contractor shall provide, maintain and keep in good sanitary condition adequate sanitary accommodation and provide facilities for pure drinking water at all times for the use of men engaged on the works and shall remove and clear away the same on completion of the works. Adequate precautions shall be taken by the contractor, to prevent nuisance of any kind on the works or the lands adjoining the same.

The contractor shall arrange to provide first-aid treatment to the labourers engaged on the works. He shall within 24 hours of the occurrence of any accident at or about the site or in connection with execution of the works, report such accident to the Owner and also to the competent authority where such report is required by law.

37. DISMISSAL OF WORKMEN

The contractor shall on the request of the Owner immediately dismiss from works any person employed thereon by him, who may in the opinion of the Owner be unsuitable or incompetent or who may misconduct himself. Such discharges shall not be the basis of any claim for compensation or damages against the Owner or any of their officer or employees.

38. ASSIGNMENT

The whole of the works 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 or interest therein nor, shall take a new partner, without written consent of the Owner and no subletting shall relieve the contractor from the full and entire responsibility of the contract or from active superintendence of the work during their progress.

39. NOMINATED SUB-CONTRACTOR

All specialists, Merchants, Tradesmen and others executing any work or supply and fixing any goods for which prime cost prices or provisional sums are included in the Schedule of Quantities/Rates and/or specifications who may be nominated or selected by the Owner are hereby declared to be sub-contractors employed by the contractor and are herein referred to as nominated sub-contractors.

No nominated sub-contractor shall be employed on or in connection with the works against whom the contractor shall make reasonable objection or have where the Owner and contractor shall otherwise agree who will not enter into a contract provided:

a) That the nominated sub-contractor shall indemnify the contractor against the same obligations in respect of the sub-contract as the Contractor is under in respect of this contract.
b) That the contractor shall indemnify the owner against claims in respect of any negligence by the sub-contractor, his servants or agents or any misuse by him or them of any scaffolding or other plants the property of the contractor or under any workmen's compensation Act in force.

40. DAMAGE TO PERSONS AND PROPERTY INSURANCE ETC.

The contractor shall be responsible for all injury to the work or workmen to persons, animals or things and for all damages to the structural and/or decorative part of property which may arise from the operations or neglect of himself of any sub-contractor or of any of his or a 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 this contract. The clause shall be held to include inter-alia, any damage to buildings whether immediately adjacent or otherwise, and any damage to roads, streets, footpaths or ways as well as damages caused to the buildings and the works forming the subject of this contract by rain, wind or other inclemency of the weather. The contractor shall indemnify the Owner and hold harmless in respect of all and any expenses arising from any such injury or damages to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of compensation or damages consequent upon such claim.

The contractor shall reinstate all damage of every sort mentioned in this clause, so as to deliver the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damages to the property or third parties.

The contractor shall effect the insurance necessary and indemnify the Owner entirely from all responsibility in this respect. The insurance must be placed with a company approved by the Owner and must be effected jointly in the name of the contractor and Owner the name of the latter being placed first in the policy i.e. Netaji Research Bureau. The scope of insurance is to include damage or loss to the contract itself till this is made over in a complete state. Insurance is compulsory and must be effected from the day of starting of the work. The contractor shall also be responsible for anything which may be excluded from damage to any property arising out of incidents, negligence or defective carrying out of this contract i.e. the contractors. All Risk Insurance shall have extension for covering cross liability arising, if any, during execution of work relating to Air Conditioning, Electrification, Erection of Lift etc. The Owner shall be at liberty and is hereby empowered to deduct the amount of any damages, compensations, costs, charges and expenses arising or accruing from or in respect of any such claim or damages from any sums due or to become due to the contractor.

41. INSURANCE

Unless otherwise instructed the contractor shall insure the works and keep them insured until the virtual completion of the contract against loss or damage by fire and/or earthquake, flood. The insurance must be placed with a company approved by the Owner, in the joint names of the Owner and the contractor for such amount and for any further sum if called to do so by the Owner, the premium of such further sum being allowed to the contractor as an authorised extra.

The contractor shall deposit the policy and receipt for premiums paid with the Owner within 21 (twenty one) days from the date of issue of work order unless otherwise instructed. In default of the contractor insuring as provided above, the Owner on his behalf may so insure and may deduct the premiums paid from any money due, or which may become due to the contractor. The contractor shall as soon as the claim under the policy is settled or the work reinstated by the Insurance Company should they elect to do so, proceed with due diligence with the completion of the works in the same manner as though the fire has not occurred and in all respects under the conditions of the contract. The contractor in case of rebuilding or reinstatement after fire shall be entitled to extension of time for completion as the Owner may deem fit.

42. ACCOUNTS RECEIPTS AND VOUCHERS

The contractor shall, upon the request of the Owner furnish them with all the invoices, accounts, receipts and other vouchers that they may require in connection with the works under this contract. If the contractor shall use materials less than what he is required under the contract, the value of the difference in the quantity of the materials he was required to use and that he actually used shall be deducted from his dues. The decision of the Owner shall be final and binding on the contractor as to the amount of materials the contractor is required to use for any work under this contract.

43. MEASUREMENT OF WORKS

The contractor will weekly record and submit measurements for verification and endorsement of Project Management Consultant/ representatives of Consultant and Owner. The Contractor should submit the bill with such endorsement. The joint measured so recorded will be made use for preparation of the bills by the contractor.

The Consultant shall from time to time intimate to the contractor that he requires the works to be measured, and the contractor shall forthwith attend or send a Qualified Agent to assist the Consultant or the Consultant's representative/Owner's representatives in taking such measurements and calculations and to furnish all particulars or to give all assistance required by either of them.

Should the contractor not attend or neglect or omit to send such Agent then the measurement taken by the Consultant or a representative approved by him shall be taken to be the correct measurement of the works, such measurement shall be net quantities for the work produced.

The contractor or his Agents may at the time of measurement take such notes and measurements as he may require. All authorised extra works, omissions and all variations made without the Consultant's knowledge, if subsequently sanctioned by him in writing, with the approval of the Owner shall be included in such measurements. The final measurement should be done within three months from the date of completion of work jointly by the Consultant and/or his representative. If the contractor fails to comply, the measurements taken by the Consultant will be final.

44. PAYMENTS

All bills shall be prepared by the contractor in the form prescribed by the Owner/Consultant after the measurements are endorsed as mentioned in Clause No. 43 (Measurement of Works). The bills in proper forms must be duly accompanied by detailed measurements in support of the quantities of work done and must show deductions for all previous payments, retention money, etc. The bills prepared shall be submitted to the consultant with a copy to the owner. The bill should be complete in all respects with all necessary enclosures. Failure to provide the necessary documents/information with the bill will be treated as incomplete and non submission.

The Consultant shall issue a certificate after due scrutiny of the contractor's bill stating the amount due to the contractor from the Owner within 7 days of the submission. The Owner will have the discretion to amend the certificate of Consultant if considered necessary and the contractor shall be entitled to payment thereof, within the period of honoring certificates named in these documents. The owner will make all endeavour for making the payment in a reasonable time observing all the rules/practices of the University for making payment.

The Owner will deduct retention money as described in Clause 22 of these conditions. The refund of retention money will be made as specified in the said clause.

If the Owner has supplied any materials or goods to the contractor, the cost of any such materials or goods will be progressively deducted from the amount due to the contractor in accordance with the quantities consumed in the work.

FINAL PAYMENT

The final bill shall be accompanied by a certificate of completion from the Owner/Consultant. Payments of final bill shall be made after deduction of Retention Money, which sum shall be refunded after the completion of the Defects Liability Period after receiving the Owner's/Consultant's certificate that the contractor has rectified all defects to the satisfaction of the Owner/Consultant. The acceptance of payment of the final bill by the contractor would indicate that he will have no further claim in respect of the work executed.

45. VARIATION/DEVIATION

The contractor may when authorised and shall, when directed in writing by the Owner/Consultant be bound under this contract to add and or omit, or vary the works shown in the drawings or described in the specifications or included in the priced schedule of quantities. The contractor on his own accord shall make no addition, omission or variation without such authorisation or direction. A verbal authorisation or direction by the Owner/Consultant shall when confirmed correctly by the contractor in writing within 7 days shall be deemed to have been given in writing.

The quantities of individual items may vary to any extent during execution of work which the tenderer has to keep in view while quoting the rates. Any extra claim in this regard will not be entertained.

The price of all such additional items/non-tendered items will be worked out on the basis of rates quoted for similar items in the contract wherever existing or on engineering rate analysis based on prevalent fair price of labour, material and other components as required as per the details hereinafter. The tender rates shall hold good for any increase or decrease in the tendered quantities to any extent.

No claim for an extra shall be allowed unless it shall have been executed by the authorisation of the Owner/Consultant as herein mentioned. Any such extra is herein referred to as an authorised extra. No variations, i.e. additions, omissions or substitutions shall vitiate the contract.

The rates of items not included in the Schedule of quantities shall be settled by the Consultant in accordance with the following rules:

a) If the rates for the additional, altered or substituted works are specified in the contract for the work, the contractor is bound to carry out the additional, altered and substituted works at the same rates as are specified in the contract for the work.
b) If the rates for the additional, altered or substituted works are not specifically provided in the contract for the work, the rates will be derived from the rates for a similar class of work as are specified in the contract for the work.
c) If the rates for the additional, altered or substituted works can not be specified in the sub-clause (a) (b) above, the rates shall be derived on the basis of cost of materials and labour (rates for materials and labour will be as per the prevalent market rates for the same) plus 15% to cover overheads, supervision and profit etc. plus prevalent sales tax on works contract.

46. SUBSTITUTION

Should the contractor desire to substitute any materials and workmanship, he/they must obtain the approval of the Owner/Consultant in writing for any such substitution well in advance. Materials designated in this specification indefinitely by such term as a "Equal" or "Other approved" etc. specific approval of the Owner/Consultant has been obtained in writing.

47. PREPARATION OF BUILDING WORKS FOR OCCUPATION AND USE ON COMPLETION

The whole of the work will be thoroughly inspected by the contractor and deficiencies and defects put right. On completion of such inspection the contractor shall inform the Owner that he has completed the work and it is ready for inspection.
On completion the contractor shall clean all windows and doors including the cleaning and oiling if necessary, of all hardware, inside and outside, all floors staircases, and every part of the building. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Owner.

48. CLEARING SITE ON COMPLETION

On completion of the works the contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and the works clean and in a workmanlike condition to the satisfaction of the Owner/Consultant.

49. DEFECTS AFTER COMPLETION

The contractor shall make good at his own cost and to the satisfaction of the Owner all defects, shrinkage, settlements or other faults which may appear within 6 months after completion of the work. In default the Owner may employ and pay other persons to amend and make good such damages, losses and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damages, loss and expenses shall be recoverable from him by the Owner or may be deducted by the Owner, in lieu of such amending and making good by the contractor, deduct from any money due to the contractor a sum equivalent to the cost of amending such work and in the event of the amount retained being insufficient, recover that balance from the contractor from the amount retained together with any expenses the Owner may have incurred in connection therewith.

50. CONCEALED WORK

The contractor shall give not less than 5 days notice to the Owner/Consultant whenever any work is to be buried in the earth, concrete or in the bodies of walls or otherwise becoming inaccessible later on, in order that the work may be inspected and correct dimensions taken before such burial. In default thereof the same shall, at the opinion of the Owner/Consultant be either opened up for measurement at the contractor's expense or no payment may be made for such materials. Should any dispute for differences arise after the execution of any work as to measurements etc. or other matters which cannot be conveniently tested or checked, the notes of the Owner/Consultant shall be accepted as correct and binding on the contractor.

51. ESCALATION

There will not be any provision for escalation for the rates quoted in the contract. The rate quoted shall be firm for the tenure of the contract (including extension of time, if any, granted) and will not be subject to any fluctuation due to increase in cost of materials, labour, taxes, octroi, etc..

52. Deleted

53. IDLE LABOUR

Whatever the reasons may be, no claim for idle labour, additional establishment cost of hire and labour charges of tools and plants would be entertained under any circumstances.

54. SUSPENSION

If the contractor except on account of any legal restraint upon the Owner preventing the continuance of the work or in the opinion of the Owner shall neglect or fail to proceed with due diligence in the performance of his part of the contract or if he shall more than once make default, the Owner shall have the power to give notice in writing to the contractor requiring the work be proceeded within a reasonable manner and with reasonable dispatch, such notice purport to be a notice under this clause.

After such notice shall have been given the contractor shall not be at liberty to remove from the site of the works or from any ground contiguous thereto any plant for materials to subsist from the date of such notice being given until the notice shall have been complied with. If the contractor fails even after 7 (seven) days of such notice to proceed with the works as therein prescribed, the Owner may proceed as provided in Clause 55 (Termination of Contract by Owner).

55. TERMINATION OF CONTRACT BY OWNER

If the contractor being a company go into liquidation whether voluntary or compulsory or being a firm shall be dissolved or being an individual shall be adjudicated insolvent or shall make an assignment or a composition for the benefit of the greater part, in number of amount of his creditors or shall enter into a Deed or arrangement with his creditors, or if the Official Assignee in insolvency, or the Receiver of the contractor in insolvency, shall repudiate the contract, or if a Receiver of the contractor's firm appointed by the court shall be unable within fourteen days after notice to him requiring him to do so, to show to the reasonable satisfaction of the Owner that he is able to carry out and fulfil the contract, and if so required by the Owner to give reasonable security therefor, or if the contractor shall suffer execution to be issued, or shall suffer any payment under this contract to be attached by or on behalf of and of the creditors of the contractor, or shall assign, charge of encumber this contract or any payments due or which may become due to the contractor, thereunder, or shall neglect or fail to observe and perform all or any of the acts matters of things by this contract, to be observed and performed by the contractor within three clear days after the notice shall have been given to the contractor in manner hereinafter mentioned requiring the contractor to observe or perform the same or shall use improper materials or workmanship in carrying on the works, or shall in the opinion of the Owner not exercise such diligence and make such due progress as would enable the work to be completed within due time agreed upon and shall fail to proceed to the satisfaction of the Owner after three clear days notice requiring the contractor so to do shall have been given to the contractor as hereinafter mentioned, or shall abandon the contract, then and in any of the said cases, the Owner may notwithstanding previous waiver determine the contract by a notice in writing to the effect as hereinafter mentioned, but without thereby affecting the powers of the Owner of the obligations and liabilities of the contractor the whole of which shall continue in force as fully as if the contract, had not been so determined and as if the works subsequently executed had been executed by or on behalf of the contractor (without thereby creating any trust in favour of the contractor) further the Owner or his agent, or servants, may enter upon and take possession of the work and all plants, tools, scaffoldings, sheds, machinery, steam and other power, utensils and materials lying upon premises or the adjoining lands or roads and sell the same as his own property or may employ the same by means of his own servants and workmen in carrying on the completing the works or by employing any other contractors or other persons or person to complete the works, and the contractor shall not in any way interrupt or do any act, matter or things to prevent or hinder such other contractors or other persons or person employed from completing and finishing or using the materials and plants for the works when the works shall be completed, or as soon thereafter as conveniently may be, the Owner shall give notice in writing to the contractor to remove his surplus materials and plants and should the contractor fail to do so within a period of 14 days after receipt by him the Owner may sell the same by Public Auction and shall give credit to the contractor for the amount so realised. Any expenses or losses incurred by the Owner in getting the works carried out by other contractors shall be adjusted against the amount payable to the contractor by way of selling his tools and plants or

due on account of work carried out by the contractor prior to engaging other contractors.

56. WATER SUPPLY

The rates quoted by the contractor shall include all expenditure for providing water for the full contract period required for the works, including that for the work people and all staff on the site. He shall make his own arrangement for the supply of good quality water suitable for use in the works and the work people. He shall obtain municipal connection and all charges for connection and consumption shall be borne by him. If municipal water is not available, or inadequate, he shall make other arrangements like sinking tubewells, or making bore-wells, or transport from outside by tanker, or any other suitable means entirely at his cost, and no separate payment for the same will be made. In any case, there should not be any deficiency of water for the work in view of quality.

57. POWER

The contractor shall at his own cost arrange for necessary power for construction and lighting for the entire period of contract. If however, sparable power is available in the premises, the contractor shall make his own arrangement to obtain necessary connection, maintain an efficient service of electric lights and power and shall pay for all the requisite charges for the same as stipulated by the Institute of Cost Accountants of India.

The Owner, as well as the Consultant shall give all the recommendations necessary to obtain power and water connections from the concerned authorities, but the responsibility for obtaining the same shall rest with the contractor.

If any other contractor, appointed by the Owner, is required to use water and power, he shall be allowed to use the same and make temporary connections from the supply arranged by the main contractor at rates and terms that may be mutually agreed upon by both, failing which, at rates, terms and conditions that may be decided by the Consultant.

58. LAND FOR CONTRACTOR'S ESTABLISHMENT

For the purpose of construction of contractor's storeyard, godowns, site office, etc., the contractor may utilize with the permission of the Consultant, portion of the land belonging to the Owner if available at such location as would not interfere with the execution of the works. The contractor shall for this purpose submit to the Consultant for his approval a plan or plans of the proposed layouts for the site facilities. The Consultant reserves the right to alter and modify the contractors' proposal as he may deem fit.

59. METHOD OF MEASUREMENT

Unless otherwise mentioned elsewhere in the tender measurement will be on the net quantities of work produced in accordance with upto date rules laid down by the relevant IS specifications. In the event of any dispute with regard to the measurement of the work executed, the decision of the Consultant/Owner shall be final and binding on the contractor.

60. ACTION WHERE NO SPECIFICATION

In the case of any class of work for which there is no such specification in Technical Specification, such work shall be carried out in accordance with the I.S. Specification and in the event of there being no I.S. specification, then in such case the work shall be carried out in all respect in accordance with the instructions and requirements of the Consultant/Owner.

61. CONTRACTOR NOT TO DEPOSIT MATERIALS IN A MANNER THAT MAY INCONVENIENCE TO THE PUBLIC

The contractor(s) shall not deposit materials on any site which will seriously inconvenience the public. The Consultant may require the contractor to remove any materials, which are considered by him to be a danger or inconvenience to the public or cause them to be removed at the contractor's cost.

62. LIQUIDATED DEMAGES

The time allowed for carrying out the work as envisaged in the tender shall be strictly observed by the contractor and shall be reckoned from the 14th day from the date of issue of work order or the date on which possession of site is given to the contractor whichever is earlier. The work shall throughout the stipulated period of the contract be proceeded with, with all the due diligence (time being deemed to be of the essence of the contract, on the part of the contractor) and the contractor shall pay to the Owner, without prejudice to other right of the Owner as

Liquidated Damages and not as penalty at 0.5% of the value of work for every week after the date stipulated "Time of Completion" or the extended date subject to a maximum of 5% of contract value. The Owner may deduct such sum from the contractor's security deposit and/or any sum payable to the contractor at that time or later. The 'Liquidated Damages' as stipulated shall be considered as a genuine pre-estimate of the loss/damage suffered by the Owner due to non-completion of the work in time. Decision of Owner in this respect shall be final and binding to the contractor.

63. ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

In any case in which under any clause or clauses of this contract, the contractor shall have rendered himself liable to pay liquidated damages amounting to the whole or his security deposit (whether paid in one sum or deducted by installments) the Owner/Consultant shall have power to adopt any of the following courses as they may deem best suited to the interest of the Owner:-

a) To rescind the contract (of which rescission notice in writing to the contractor under hand of the Owner/Consultant shall be conclusive evidence), and in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Owner.

b) To employ labour paid by the Owner and to supply materials to carry out the work, or any part of the work, debiting the contractor with the cost of the labour and price of material (of the amount of which cost and price of a certificate of the Consultant/Owner shall be final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract the certificate of Consultant/Owner as to the value of the work done, shall be final and conclusive against the contractor.

c) To measure up the work of the contractor, and to take such part thereof as shall be unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount of which excess the certificates in writing of the Consultant/Owner shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the Owner under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or a sufficient part thereof.

In the event of any of above courses being adopted by the Owner/Consultant the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements, or make any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contractor shall be rescind under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum or any work thereto for actually performed under this contract, unless, and until the Owner/Consultant will have certified in writing the performance of such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

64. GUARANTEE FOR THE SPECIALISED WORKS

Wherever provision for submission of a guarantee has been advised the same shall be submitted from the specialised agency along with a counter guarantee by the main contractor engaged for the work. The guarantee shall be furnished on a non-judicial stamp paper of appropriate value. If the contractor is required to submit guarantee/guarantees for any item/items for a period of more than 12 moths, the guarantee/guarantees in case of those items shall remain valid even after expiry of the defect liability period of 6 months as stipulated in the contract**.**

65. TESTS/RESULTS/SITE REGISTERS ETC.

The contractor will be required to maintain the following registers at site of work and should produce the same for inspection of the Owner/Consultant whenever desired by them.
Typical proforma are enclosed (Refer Table I to XIV)

i)	Table	-	I	Proforma of Cement/Plant/Lead/Cico
ii)	Table	-	II	Proforma of Materials at Site Account.
iii)	Table	-	III	Proforma of Sieve analysis of fine aggregate.
iv)	Table	-	IV	Proforma of Sieve analysis of coarse aggregate.
v)	Table	-	V	Proforma of Hindrance to work.

vi)	Table	-	VI	Proforma of Running Account Bill.
vii)	Table	-	VII	Proforma of Memorandum for payment.
viii)	Table	-	VIII	Proforma of Cement Consumption Chart.

Contractor will have to submit their Running Account Bills in printed form shown in Table VI to VIII.

66. INCOME TAX/SALES TAX ON WORKS CONTRACT

Statutory deduction of Income Tax/Sales Tax on works contract shall be made from all interim and final payments as per extend statute.

67. AGREEMENT

The successful contractor will be required to enter into an agreement in accordance with the Draft Agreement form enclosed and the schedule of conditions within 15 days from the date of the contractor is advised by the Owner/Consultant that his tender has been accepted and he shall pay for all stamps and legal expenses incidental thereto. However, the written acceptance by the Owner of a tender will constitute a binding contract between the Owner and the person who so tendering whether such formal agreement is or is not subsequently executed.

68. NO COMPENSATION FOR ALTERATION IN, OR RESTRICTION OF WORK TO BE CARRIED OUT

It at any time after the commencement of the work, the Owner/Consultant shall for any reason whatsoever not require the whole work thereof as specified in the tender to be carried out the Consultant/Owner shall give notice in writing of the fact to the contractor who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage with which he might have derived from the execution of the work in full, but which he did not derive in consequence of the full amount of the work not having been carried out; neither shall he has any claim for compensation by reason of any alterations having been made in the original specification, drawing, designs and instructions which shall involve any curtailment of the work as originally contemplated.

69. ARBITRATION

All disputes or difference of any kind whatsoever which shall at any time arise between the parties hereto touching or concerning the works or the execution or maintenance thereof of this contract or the rights touching or concerning the works or the execution or maintenance thereof of this contract or the construction remaining in operation or effect thereof or to the rights or liabilities of the parties arising out of or in relation thereto whether during or after determination, foreclosure or breach of the contract (other than those in respect of which the decision of any person or persons is by the contract expressed to be final and binding) shall after written notice by either party to the contract to the other of them and to the Appointing Authority who shall be appointed for this purpose by the Owner be referred for adjudication to a sole Arbitrator to be appointed as hereinafter provided.

For the purpose of appointing the sole Arbitrator referred to above, the Appointing Authority will send within thirty days of receipt by him of the written notice aforesaid to the contractor a panel of three names of persons who shall be presently unconnected with the organisation for which the work is executed from the following categories of Arbitrators:-

1. Retired High Court/Supreme Court Judges, who have experience in handling Arbitration cases.
2. Member of the Council of Arbitration.
3. Fellow of the Institution of Engineers (India)
4. Eminent Retired Chief Engineers from State/Central P.W.D./Public Sector Undertakings of good reputation and integrity.
5. Fellow of The Indian Institute of Architects.

The contractor shall on receipt by him of the names of aforesaid, select any one of the persons named to be appointed as a sole Arbitrator and communicate his name to the Appointing Authority within thirty days of receipt by him of the names. The Appointing Authority shall thereupon without any delay appoint the said person as the sole Arbitrator. If the contractor fails to communicate such selection as provided above within the period specified, the Appointing Authority shall make the selection and appoint the selected person as the Sole Arbitrator.
If the Appointing Authority fails to send to the contractor the panel of three names as aforesaid within the period specified, the contractor shall send to the Appointing Authority a panel of three names of persons out of the above mentioned 5 categories of Arbitrators who shall be unconnected with either party. The appointing authority shall on receipt by him of the names of aforesaid select any one of the persons named and appoint him as the sole Arbitrator. If the appointing authority fails to select the person and appoint him as the Sole Arbitrator within 30 days of receipt by him of the panel and inform the contractor accordingly, the contractor shall be entitled to

appoint one of the persons from the panel as the Sole Arbitrator and communicate his name to the Appointing Authority.

If the Arbitrator so appointed is unable or unwilling to act or resigns from his appointment or vacates his office due to any reason whatsoever another sole Arbitrator shall be appointed as aforesaid.

The work under the contract shall, however, continue during the arbitration proceedings and no payment due or payable to the contractor shall be withheld on account of such proceedings.

The Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing.

The Arbitrator may from time to time, with the consent of the parties, enlarge the time for making and publishing the award.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him. The Arbitrator shall decide each dispute in accordance with the terms of the contract. The venue of arbitration shall be such place as may be fixed by the Arbitrator in his sole discretion.

The fees, if any, of the Arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award including the fees, if any, of the Arbitrator who may direct to and by whom, and in what manner, such costs or any part thereof shall be paid and may fix or settle the amount of costs to be so paid.

The award of the Arbitrator shall be final and binding on both the parties.

In all cases where the amount of the claim is in dispute is Rs.75,000.00 (Rupees seventy five thousand only) and above, the Arbitrator shall give reasons for the award.

It is also a term of the contract that if contractor(s) do/does not make any demand for arbitration in respect of any claim(s) within 90 days of receiving intimation from Owner/Consultant that the bill after due verification is passed for payment of a lesser amount, or otherwise the contractor's right under this agreement to refer to arbitration shall be deemed to have been forfeited and Owner/Consultant shall be relieved and discharged of their liability under this agreement in respect of such claims(s). Further it is agreed that for the purpose of this clause, such notice is deemed to have been received by the contractor(s) within 2 days of posting of the letter by Owner/Consultant or when delivered by hand immediately after receipt thereof by the contractor(s), whichever is earlier. Further a letter signed by the officials of Owner/Consultant that the letter was so posted to the contractor(s) shall be conclusive.

Subject to aforesaid the provisions of the Arbitration Act 1940 or any statutory modification or re-enactment thereof and the rules made thereunder, and for the time being in force, shall apply to the Arbitration proceeding under this clause.

70. DECLARATION

I/We have inspected the site of works and have made me/us fully acquainted with the local conditions in and around the sites of works. I/We hereby declare that I/We have gone through the conditions laid down in the Notice Inviting Tender, General Conditions of Contract, Technical Specifications and understood the same I/We quoted our rates in the schedule of quantities attached with the tender documents.

I/We shall also uniformly maintain such progress with the work, as may be directed by the Owner/Consultant to ensure completion of same within the target date as mentioned in the tender document.

_____

Witness: Signature of Tenderer

Address _____

_____

Date

SPECIAL CONDITIONS OF CONTRACT

1.0 Errors, Omissions and Discrepancies

In case of errors, omissions and/or disagreement between written and scaled dimensions on the drawings or between the drawings and specifications etc. the following order shall apply:

i) Between scaled and written dimension (or description) on a drawing, the latter shall be adopted.
ii) Between the written or shown description or dimensions in the drawings and the corresponding one in the specification the former shall be taken as correct.
iii) Between written description of the item in the specifications and descriptions in bill of quantities of the same item, the latter shall be adopted.
iv) In case of difference between rates written in figures and words, the rate in words shall prevail.
v) Between the duplicate/subsequent copies of the tender shall be taken as correct.

2.0 Ownership of drawings

All drawings, specifications and copies thereof furnished by the Institute of Cost Accountants of India, through its Consultant are the properties of the Institute of Cost Accountants of India. They are not to be used on other work.

3.0 Remedy on Contractor's failure to insure

If the contractor fails to effect and keep in force the insurance referred to above or any other insurance which he may be required to effect under the terms of contract, then and in any such case Institute of Cost Accountants of India, may effect and keep in force any such insurance and any such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Institute of Cost Accountants of India, as aforesaid from any amount due or which may become due to the contractor, or recover the same as debt from the contractor.

Without prejudice to the other rights of the Institute of Cost Accountants of India, against contractors, in respect of such default, the employer shall be entitled to deduct from any sums payable to the contractor the amount of any damages, costs, charges, and other expenses paid by the Institute of Cost Accountants of India, and which are payable by the contractors under this clause. The contractor shall upon settlement by the insurer of any claim made against the insurer pursuant to a policy taken under this clause, proceed with the diligence to rebuild or repair the works destroyed or damaged. In this event all the monies received from the insurer in respect of such damage shall be paid to the contractor and the contractor shall not be entitled to any further payment in respect of the expenditure incurred for rebuilding or repairing of the materials or goods destroyed or damaged.

4.0 Time for completion

Time is the essence of the contract and shall be strictly observed by the contractor. The entire work shall be completed within a period 1 month from the date of commencement. If required in the contract or as directed by the Consultant/ Owner, the contractor shall complete certain portions of work before completion of the entire work. However the completion date shall be reckoned as the date by which the whole work is completed as per the terms of the contract. Contractor shall submit a detail bar chart of work programme keeping the stipulated time of completion of work as mentioned above for approval of Owner /Consultant showing the supply and installation of various activities of the work. The contractor shall proceed with work as per approved bar chart.

5.0 Maintenance of Registers

The contractor shall maintain the following registers as per the enclosed proforma at site work and should produce the same for inspection of Owner /Consultant whenever desired by them. The contractor shall also maintain the records/registers as required by the local authorities/Govt. from time to time.

i) Register for Cement / Paint / Lead / Specific Materials
ii) Register for Material at Site Account
iii) Register for Sieve Analysis for Fine Aggregate
iv) Register for Sieve Analysis for Coarse Aggregate
v) Register for Hindrance to Work
vi) Register for Running Account Bill
vii) Register for Memorandum of Payment
viii) Register for Consumption of Cement

6.0 Accidents

The contractor shall immediately on occurrence of any accident at or about the site or in connection with the execution of the work report such accident to the Owner /Consultant. The contractor shall also report immediately to the competent authority whenever such report is required to be lodged by the law and take appropriate actions thereof.

7.0 Site Order Book

A site order book shall be maintained at site for the purpose of quick communication between the Owner /Consultant. Any communication relating to the works may be conveyed through records in the site order book and signed by the Owner /Consultant/Site Engineer. Such a communication from one party to the other shall be deemed to have been adequately served in terms of contract. Each site order book shall have machine numbered pages in triplicate and shall be carefully maintained and preserved by the contractor and shall be made available to the Owner /Consultant as and when demanded. Any instruction which the Owner /Consultant may like to issue to the contractor or the contractor may like to bring to the Owner /Consultants two copies of such instructions shall be taken from the site order book and one copy will be handed over to the party against proper acknowledgement and the second copy will be retained for their record.

8.0 Site Meetings

Site meetings will be held to review the progress and quality evaluation. The contractor shall depute a senior representative along with the site representative and other staff of approved sub-contractors and suppliers as required to the site meetings and ensure all follow up actions. Any additional review meetings shall be held if required by the Consultant/ Owner

9.0 Excise Duty, Taxes, Levies etc.

The contractor shall pay and be responsible for payment of all taxes, including VAT as applicable, duties, levies, royalties, fees, cess or charges in respect of the works including but not limited to sales tax, VAT, works contract tax, excise duty, and octroi, payable in respect of materials, equipment, plant and other things required for the contractor. All of the aforesaid taxes, duties, levies, fees and charges shall be to the contractor's account and the Institute of Cost Accountants of India shall not be required to pay any additional or extra amount on this account. Variation of taxes, duties, fees, levies etc. if any, till completion of work shall be deemed to be included in the quoted rates and no extra amount on this account will in any case be entertained. If a new tax or duty or levy or cess or royalty or octroi is imposed under as statue or law during the currency of contract the same shall be borne by the contractor.

10.0 Idle Labour

Whatever the reasons may be, no claim for idle labour, additional establishment cost of hire and labour charges of tools and plants would be entertained under any circumstances.

Contractor or his authorized sub-contractors for electrical and sanitary & plumbing works should have valid license (if applicable) for carrying out such works from the concerned statutory/local bodies/authorities.

Witness: Signature of Tenderer

Address Address

Date Date

TABLE-I

PROFORMA FOR HINDRANCE TO WORK

Name work : …… Date of Start of work: ……

Name of Contractor : …… Period of completion: ……

Agreement No. : …… Date of completion of work: …….

Sl. No.	Name of hindrance	Date of occurrence of hindrance	Date of on which hindrance was removed	Period for which hindrance existed	Signature of Site Engineer	Signature of Owner's /Consultant's representative.

TABLE-II

I. Running A/c. Bill

i) Name of Contractor/Agency :
ii) Name of work :
iii) Sl. No. of this bill :
iv) No. and date of previous bill :
v) Reference to Agreement No. :
vi) Date of written order to commence :
vii) Date of completion as per agreement :

Sl. No.	Item Description	Unit	Rate (Rs.)	As per Tender Qty.	As per Tender Amount (Rs.)	Upto Previous R/A Bill Qty.	Upto Previous R/A Bill Amount (Rs.)	Upto Date(Gross) Qty.	Upto Date(Gross) Amount (Rs.)	Present Bill Qty.	Present Bill Amount (Rs.)	Remarks
1	2	3	4	5		6		7		8		9

Note: 1. If part rate is allowed for any item, it should be indicated with reasons for allowing such rate.

2. If adhoc payment is made it should be mentioned specifically.

_____
Net value since previous bill

CERTIFICATE

The measurements on the basis of which the above entries for the Running Bill No. _____ were made have been taken jointly over _____ and are recorded at pages _____ __to _____ of measurement book No. _____.

_____	_____	_____
Signature and date of contractor	Signature and date of Consultant's Representative (Seal)	Signature and date of Site Engineer.

The work recorded in the above mentioned measurements has been done at the site satisfactorily as per tender drawings, conditions and specifications.

Consultant

Site Engineer/Owner's Engineer

TABLE-III

III. MEMORANDUM FOR PAYMENT

R/a Bill No. _____

1.	Total amount due since previous Bill (D) = (A + B)			Rs. …….
2.	PVA on account of declaration in price of steel, cement and other materials and labour as detailed in separate statements enclosed.	(C)	(+)	Rs. …….
3.	Total amount due to the Contractor (D + C)			Rs. ……. (E)

DEDUCTIONS

i)	Secured advance pain in the previous R/A bill	Rs. ……	
ii)	Retention money on value of works as per accepted tenders upto date amount Rs. ……		
	Less already recovered (-) Rs. ……		
	Balance to be recovered	Rs. ……	
iii)	Mobilisation Advance if any		
a)	Outstanding amount (principal + interest) as on date Rs. ……..		
b)	To be covered in this bill Rs. …….. _____	Rs. …….	
iv)	Any other Departmental materials cost to be recovered as per contract if any	Rs. ……	
v)	Any other Departmental Service Charges to be recovered if any, As per contract (water, power Etc.) enclose statement	Rs. …… _____	
Total deduction as per contract (E)		(-)	Rs. ……...(F)
Net amount payable as per (E – F)			Rs. ……..(G)

(Rupees ……) in words

The bill amount to Rs. …… (both figures and words) has been scrutinized by me after due test checking of the measurements of works as required and is recommended for payment.

_____	_____
Dated signature of Owner's Engineer in charge of the Project.	Consultant's Signature

STATUTORY DEDUCTIONS:

1.	Total amount due (E)	Rs. ……...
2.	Less : I.T. Payable	Rs. ……...
Net Payable		Rs.

The figures given in the Memorandum for payable has been verified and the bill passed for payment ……. …… (words in figures)

Date ……	_____ Signature of the Owner

APPENDIX

Name of Work	:	Air Conditioning work in Auditorium
Location	:	Institute of Cost Accountants of India, 12, Sudder Street, Kolkata – 700 016
Scope of work	:	As above and further detailed in the General Conditions of Contact.
Defect Liability Period	:	6 months.
Date of Commencement	:	14 days from the date of issue of work order or the date on which the contractor is instructed to take possession of the site, which-ever is earlier.
Date/time of completion	:	1 month
Liquidated Damages	:	0.5% of the accepted tender amount per week of delay subject to a ceiling 5% of the accepted contracted sum.
Earnest Money Deposit (EMD)	:	Rs. 56,000.00 in the form of Bank Draft drawn in favour of Institute of Cost Accountants of India payable at Kolkata
Total Retention Money	:	Not to exceed 10% of the value of work (including EMD)
Release of Retention Money	:	50% after virtual completion and balance 50% after expiry of the defects liability period.
Period for honouring Certificates	:	15 days for Interim Certificates and three weeks for the final certificate from the date of certification.
Interest for delayed payment	:	Nil

TECHNICAL SPECIFICATIONS FOR AIR CONDITIONING WORK

SECTION – II

DESIGN BASIS & SCOPE OF WORKS

LOCATION AND CLIMATE

The project site is located at ICAI Project , Kolkata . The ambient conditions & inside conditions to be maintained are as follows:

OUTSIDE DESIGN CONDITIONS

DESCRIPTION	*SUMMER*	*MONSOON*	*WINTER*
DRY BULB TEMP. DEG C	40.5	32.2	11.1
WET BULB TEMP. DEG C	28.3	30.0	07.2
RELATIVE HUMIDITY	40 %	87 %	60 %

ALTITUDE - **6M ABOVE MEAN SEA LEVEL**

GEOGRAPHICAL LOCATION - **22.59 DEG N**

INSIDE DESIGN CONDITIONS

SL.NO.	**DESCRIPTION**	**TEMP. / RH**
1	Dry Bulb Temperature	23 +/- 1 DEG C.
2	Relative Humidity	50%

The air conditioning system for the Auditorium shall be designed to cater for the **Comfort cooling** application only.

SCOPE OF WORK

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labors, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete air conditioning system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The central Heating, Ventilation and Air-Conditioning **(HVAC)** system shall comprise of following:

a) HIGH SIDE EQUIPMENT

- Design of the equipment based on the data furnished in the document.
- Procurement of materials within the battery limits as per the schedule given by Owner / Project Managers
- Manufacturing as per standards & details furnished in the specifications
- Assembly
- Testing in Shop before delivery
- Inspection
- Insurance up to handing over
- Packing & Forwarding
- Transportation
- Installation at Site as per the schedule given by Owner/ PROJECT MANAGERS
- Submission of method statements for execution
- Commissioning in the presence of specialized agency (manufacturer's representative)
- Performance Guarantee run
- Handing over

b) **LOW SIDE WORKS**

- Design of the equipment based on the data furnished in the document.
- Procurement of materials within the battery limits as per the schedule given by Owner / Project Managers
- Manufacturing as per specifications mentioned in the document
- Assembly at Site
- Commissioning
- Testing of all equipment as per the list attached in the document

- Performance Guarantee run
- Handing over

Supply of various equipment as per the relevant Specification & Drawings, unloading, receiving, inspection, storing, transportation to work site, handling, assembling, cleaning, mechanical erection, assisting main contractor in associated civil works which are required for ac system, Installation, alignment, testing and commissioning and handing over in working condition of all items covered below but not limited to it:

- Air-Cooled Chiller Units
- Air Handling unit with 6R deep cooling Coil.
- Chilled Water Pumps
- Providing necessary vibration isolators for all mechanical equipment.
- Any other items for successful functioning of the system whether specifically mentioned or not.
- Preparation of execution drawings and as built-in- drawings.
- Coordination with other subcontractors with regard to installation of items in Air Conditioning contractor's scope.
- The extent of work services under the contract include all items shown on the drawings, indicated in companion with specifications, not withstanding the fact that such items have been omitted from the BOQ. All equipment and services which are required to complete the intent of the contract shall also be deemed to be within the scope of the contract.
- All Civil Foundation, Minor Civil work etc required to complete the work is included in the above scope.
- Supply and fixing of G.I./wooden frame for mounting of grilles in masonry walls is included in the above scope.
- Supply and fixing of GSS frame for mounting of grilles / diffusers in false ceiling / boxing is included in the above scope.

SECTION – III

TECHNICAL SPECIFICATIONS

DESIGN PARAMETERS

3.00 Given below are some design parameters which should be followed in addition to those given in various sections of technical specifications enclosed.

3.01 Air Cooled Scroll Chiller

Performance rating of the water chilling machine shall be based on the following design parameters:

Temperature of chilled water entering chiller	:	(54° F) 12.0° C
Temperature of chilled water leaving chiller	:	(44° F) 7.0° C
Fouling factor for chiller in FPS unit	:	0.0005
Temperature of condenser entering Air	:	(104° F) 40 ° C
Fouling factor for condenser in FPS unit	:	0.001
Refrigerant	:	R 407C / R-22.

3.02 Floor Mounted Type Air Handling Unit

a) Maximum face velocity across cooling coil MPM : 152.0

b) Maximum face velocity across pre filters MPM : 152.0

c) Fan outlet velocity (maximum) MPS : 10.0

d) Cooling Coil : 6 Row

e) Other Design parameter for selection of Air Handling Unit and its components shall be:

Maximum fan speed

a.	Fan above 450 mm dia	:	1000 RPM
b.	Fan up to and including 450 mm dia	:	1450 RPM
Maximum fan motor speed		:	1450 RPM

Piping shall be sized for the following design parameters:

Maximum velocity	:	1.2 m/Sec (4 fps) for piping 50 mm & under
	:	2.5 m/Sec (8.2 fps) for piping over 50 MM dia
Maximum friction	:	15 k Pa per 30 M Run (5 ft per 100 ft Run)

3.04 DUCTING WORK

a)	Method of Duct Design	:	Equal friction Method
b)	Maximum air velocity in supply duct MPM	:	550.0
c)	Maximum air velocity in return duct MPM	:	305.0
d)	Friction loss in duct (maxm.) MM Wg in 100 Mt run.	:	6.66
e)	Maximum Velocity at supply air grill outlet MPM	:	150.00

Filtration:

Recalculated air (mixed fresh & return air) at air handling units.	:	Washable synthetic type air filters having 90% efficiency down to 10 microns (MERV 8).

3.05 INSULATION

Maximum temperature rise in the supply air duct from Air-handlers outlet to farthest outlet in ºC 1.10

1.2 QUALITY ASSURANCE PROGRAM

a. Chillers shall be rated in accordance with Parameters indicated in Schedule of Quantities. Pressure vessels shall be designed, constructed, tested, stamped and complete with devices in accordance with ANSI/ASHRAE 15-1989 Safety Code and ASME Code.

b. Chillers shall be the product of a manufacturer normally supplying this type of equipment.

c. The chiller shall be designed/manufactured and tested in accordance with the applicable portions of the latest revisions of the following Standards and Codes.

ARI 550 – 98 - Air Conditioning and refrigeration institute standard for specifications, testing & rating.

ARI 575 - Air Conditioning and Refrigeration Institute. Standard Method of Measuring Machinery Sound Within Equipment Rooms (Base of all data presented or field testing of equipment with relation to sound requirements).

ASME CODE - American Society of Mechanical Engineers Code for Unfired Pressure Vessels - Section VIII (Design, construction, testing and certification of pressure vessels).

ANSI-B9.1 - American National Standards Institute. Safety Code for Mechanical Refrigeration (overall general safety requirements, relief device sizing, etc.)

ANSI-B31.5 - American National Standards Institute. Code for Refrigerant Piping.

ISO R281 - Rolling Bearings – Dynamic Load Ratings and Rating for Life.

1.3 CAPACITY

Actual refrigeration capacity of chilling machine shall be as indicated in Schedule of Quantities.

1.4 COMPRESSOR

The compressor shall have a semi-hermetic direct/gear drive high RPM rotary compressor with capacity control slide valve, oil sump heater and differential pressure refrigerant oil flow system. Multiple pressure lubricated rolling element bearing groups shall support the rotating assembly.

1.5 MICRO COMPUTER CONTROL CENTRE

Each unit shall be furnished with microcomputer control centre in a locked enclosure, factory mounted, wired and tested. The control center shall include a 40-character alphanumeric display showing all system parameters in English language with numeric data in English (FPS) units .

Digital programming of essential set points through a colour coded, tactile-feel keypad shall include: entering and leaving chilled water temperature ; percent loading: pull down demand limiting; seven-day time clock for starting and stopping chiller (complete with local holiday schedule); and remote reset temperature range.

All safety and cycling shutdowns shall be annunciated through the alphanumeric display and consist of day, time, cause of shutdown, and type of restart required. Safety shutdowns shall include: high oil pressure; high compressor discharge temperature: low evaporator pressure: motor controller fault: and sensor malfunctions. Cycling shutdowns shall include: low water temperature; low oil temperature: chiller/condenser water flow interruption; power fault; internal time clock; and entire cycle.

System operating information shall include: return/leaving chilled water temperatures; return/leaving condenser water temperatures; evaporator/condenser refrigerant pressure; differential oil pressure; percent motor current; evaporator/condenser saturation temperatures; operating hours (Hours Run) and number of compressor starts.

Security access shall be provided to prevent unauthorized change of set points to allow local or remote control of the chiller, and to allow manual operation of the prorogation vanes and oil pump.

The chiller shall be provided with an RS-232 port to output all system operating data, shutdown/ cycling messages and a record of the last four cycling or safety shutdowns to a remote printer or Building Automation System (BAS). The control center shall be programmable to provide data logs to the BAS/printer at a set time interval.

Control center shall be able to interface with the Building Automation System (BAS) to provide remote chiller start/stop reset of chilled water temperature reset of current limit; and status messages indicating chiller is ready to start, chiller is operating, chiller is shut down on a safety requiring reset, and chiller is shut down on a recycling safety.

1.6 INTERFACE WITH BUILDING AUTOMATION SYSTEM

All necessary hardware / software to integrate the chiller panel to BAS system shall be provided free of cost by chiller manufacturer / supplier. For the integration of Microprocessor Panel of the chilling machine with the Building Automation System, an Interface Control Document shall be developed by BAS Contractor. It shall be responsibility of Chiller supplier to provide following to BAS Contractor for preparing the interface.

a. Hardware Protocol of Chiller Microprocessor panel.

b. Software Protocol of Chiller Microprocessor panel.

c. Communication structure relating to collection of message / event information.

d. Description of the formatted packets / blocks of data which construct controller commands / responses.

e. Written permission to BAS contractor to develop the interface without any financial implication.

2.7 ELECTRIC MOTOR

Motor shall be energy efficient and suitable for 415±10% volts, 3 phase, 50 cycles AC supply. Hermetic/semi hermetic motors shall be suction gas cooled ,two pole, squirrel cage induction types. In case of open compressor type motors shall be screen protected drip proof squirrel cage induction type. Motor shall be designed and guaranteed for continuous operation. Insulation of motors shall be `B' class. Temperature rise of motor under rated service conditions shall not exceed 80 º C (by resistance method of measurement) over an ambient of 40 º C. the motor shall be provided with a combination of ball and roller bearing. Starting current at rated voltage and frequency shall not exceed 2 times of full load current at rated voltage and frequency.

Terminal box of sturdy construction shall provide enough space for terminating, connecting and earthing of PVC - insulated aluminium conductor cable. All terminal boxes shall be located at the same side of the motor and have terminal and cable glands suitable for the specified cables.

The efficiency and power factor shall be not less than the following values, at rated voltage and frequency and at the specified loads.

Load	**Efficiency**	**Power Factor**
Full Load	96%	0.95
3/4	96%	0.92
1/2	96%	0.88

Starting current at rated voltage and frequency shall not exceed 2 times the full load current at the rated voltage and frequency. The total efficiency shall include losses of the auxiliaries such as independent excitation, motor-driven fans, lube-oil pumps etc. Over voltage surge protection shall be provided to protect motor.

2.8 STARTER

Shall be close transition star delta starter or soft starter to ensure starting current at rated voltage & frequency does not exceed 2 times of full load current.
All components of starter shall be housed in dust proof enclosure and suitable for 415 ± 10% volts 50 cycles 3 phase AC power supply.

2.9 EVAPORATOR AND CONDENSER

a. Shells and Water Boxes : The evaporator and condenser shells will be of rolled carbon steel plate with fusion welded seams. Hinged water boxes of cast iron or welded steel with stub-out water connections shall be provided to permit access for tube cleaning and replacement. Water boxes shall be designed for 150 psig working pressure and hydraulically tested at 225 psig. The tubes shall be finned from outside having spiral ridges from inside, roller expanded into the tube sheets providing a leak proof seal. The tube material will be copper, intermediate steel tube supports should be provided at intervals not exceeding 1200 mm.

b. Evaporator (Chiller) : Chiller shall be provided with eliminator to prevent liquid carry over to the compressor. The chiller shall be provided with liquid level sight glass and a relief device (of the bursting type) to prevent excess pressure in the heat exchanger. The chiller shall be horizontal, shell and tube type, provided with the following connections and accessories, as separately identified in the schedule of quantities :

   i. Refrigerant inlet and outlet pressure gages.

   ii. Water inlet and outlet connections.

   iii. Drain and vent connections with stop valves.

   iv. Pressure gauges on water inlet and outlet connections.

   v. Descaling valves.

   Chiller shall be insulated with 25 mm thick rubber based closed cell polyurethane electronic foam. The insulation shall be set with compound recommended by the insulation manufacturer and shall be applied sealing the joints. The insulation shall be applied in such a manner that water boxes and covers shall be removable without damaging it.

c. Condenser: The condenser shall be Air cooled. It shall be complete with the accessories as separately defined in the schedule of quantities :

1.10 INSTALLATION

The chilling machine shall be installed over a platform and shall be adequately isolated as per manufacturers recommendations against transmission of vibrations to the building structure.

1.11 PAINTING

Screw water chilling machine shall be finished with durable enamel paint. Shop coats of paint that have become marred during shipment or erection, shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop-painted surfaces.

1.12 PERFORMANCE RATING :

The unit shall be selected for the lowest operating noise level Capacity ratings, and power consumption with operating points clearly indicated, shall be submitted and verified at the time of testing and commissioning of the installation. Capacity shall be ascertained by measurements of chilled water flow rate and temperature of chilled water in and out of the chilling unit.

Power consumption shall be computed from measurements of incoming voltage & input current to the chilling machine.

1.13 WITNESS TEST

Prior to shipment, chilling machines shall be subjected to inspection and witness of performance tests by Consultant and Owner's representative to verify various performance parameters as confirmed by vendor earlier at the time of award of contract. Performance test shall be carried out as per procedure laid down by ARI / EUROVENT and as per Spectral specified parameter, at two points.

2.0 CHILLED WATER PUMP SETS

GENERAL

a) Work Included

This Section specifies the requirements necessary to furnish and install general service centrifugal and turbine pumps.

b) Design Criteria

Pump Selection:

i) Any pump with a constant speed driver requiring a minimum or maximum diameter impeller to meet the rated pumping conditions is not acceptable. The impeller shall be such that at least a 10 percent increase in head at the rated capacity can be obtained by installing a larger diameter impeller of the same pattern.

ii) Pumps noted on the individual pump data sheets as operating in parallel shall have head-capacity curves rising continuously to shutoff.

Impellers:

i) All impellers shall be keyed to their shafts except that "Taper lock" construction is acceptable in vertical turbine pumps up to 200 degrees F pumping temperature. Keyed shafts are preferred; however, if the impeller is held in place with a threaded fastener, a positive means shall be provided to prevent the fastener and/or the impeller from unscrewing if the pump is operated in reverse.

ii) Minimum wearing-ring clearances shall be as follows:

Minimum Wear-Ring Diameter (inches)	Diametrical Clearance (inches)
2	0.010
4	0.016
6	0.018
10	0.022

i) Clearance for intermediate sizes shall be determined by interpolation. Above clearances shall be increased by 0.005 inches when rings are made of 18-8 chrome-nickel or other material that tends to gall.

Shafts and Shaft Sleeves:

i) The shaft shall be solid where mechanical seals are specified. To provide for use of mechanical seals, the seals shall be constructed so as not to fret the shaft. If a mechanical packing is used, a sleeve shall be provided.

ii) Where employed, the shaft sleeve diameter shall be made in increments of 1/8 inch above a 1-inch diameter.

iii) The surface finish of the shaft or sleeve through the mechanical seal shall not exceed a roughness of 32 micro-inches.

iv) Pump shaft or shaft sleeve run out at the impeller shall not exceed 0.002 inch.

v) Pump shafts shall be guarded with OSHA-compliant, fully-enclosed shields (no horseshoe configurations), that are provided by the pump supplier.

Vibration:

i) Peak-to-peak vibration limits shall apply to all pumps. These limits shall cover rotor vibration during shop test at rated speed and at a capacity of plus or minus 10 percent from rated capacity. Peak-to-peak limits are:

	Vibration Peak-to-Peak (mils)	
Speed (rpm)	Anti-Friction Bearings[1]	Sleeve Bearings[2]
1,800 and below	3.0	3.0
1,801 to 4,500	2.0	2.5
4,501 to 6,000		2.0
Over 6,000		1.5

[1] Measured on bearing housing.
[2] Measured on the shaft.

Mechanical Seals:

i) All pumps covered by this specification shall be equipped with mechanical seals unless otherwise noted on the individual pump data sheet. The pump vendor shall be responsible for obtaining a written recommendation and full guarantee from the seal manufacturer for each mechanical seal service. The recommendation is subject to review by Clients prior to placement of a purchase order for the mechanical seals.

ii) All mechanical seals shall be of a single, stationary, inside, hydraulically balanced cartridge design unless otherwise specified on the individual pump data sheet. Built-in or integral type mechanical seals are unacceptable except for "close-coupled" pumps. Further, all mechanical seals shall have static O-ring shaft seals.

iii) Seal gland plates shall be of the same material as the pump case except that carbon steel or more corrosion resistant plates shall be furnished with cast iron, ductile iron, or bronze cases, unless otherwise noted on the individual pump data sheet.

iv) Gland plates retaining mechanical seals shall have at least four bolts.

v) The seal gland plate shall have a throttle bushing to restrict the flow to atmosphere in the event of a seal failure.

vi) Metallic cyclone separators are not acceptable for seal flush service in corrosive applications.

vii) All seal flush systems furnished by the pump vendor shall be provided with a visual means of determining that the flush liquid is flowing to the mechanical seal.

viii) Single mechanical seals, when flushed, shall have the seal gland plate arranged so that the flush liquid is not directed at the seal mating faces.

ix) Heat exchangers used for cooling mechanical seal flushing streams shall have 1/2 inch minimum size tubing of one piece, without welded, brazed, or soldered joints, for the process liquid.

x) Provide a check valve between the seal-flush system and the cyclone separator.

Couplings:

i) All pumps shall be furnished with spacer-type couplings. Flexible couplings shall be Woods "Sure-flex" or Clients approved equivalent.

ii) In all cases, the pump vendor shall mount pump half-couplings.

iii) Removable all-metal coupling and shaft guards shall be supplied and mounted

iv) Couplings shall be mounted on shafts with cylindrical fit and keyed in placed. Cylindrical fits shall conform to ANSI B4.1.

Bearings:

i) Horizontal pump bearings shall be sealed or arranged for grease lubrication unless otherwise specified on the individual pump data sheet.

ii) Thrust bearings for vertical pumps may be located in the drivers.

iii) Vertical centrifugal bearings shall be continuously flushed using water from a clean source, independent of the tank contents.

Base plates and Mounting:

i) Horizontal pumps, except integral motor pumps, shall be furnished with cast iron or fabricated steel base plates having drip lips and drain connections. The base plates shall be extended (length and width) for the pump, driver, and all accessories, e.g., cooler(s) and oil reservoir, without overhang. Motor driver conduit boxes may extend beyond the base plate.

ii) Bases for base-mounted units shall have at least two grout holes not less than 4 inches in diameter where practical, and shall be located so the base can be grouted in place without removal of equipment driver or any auxiliaries. Grout holes shall be arranged so that any system fluid will not accumulate over the open grout. Adequate vent holes shall be provided to ensure a complete distribution of grout. Grouting is required on all base-mounted units. Grout to be applied before final alignment and before piping is connected to the pump.

iii) Driver support pads on base plates shall be machined flat and in the same plane.

iv) All pumps should be placed on inertia blocks with spring isolators.

Casings:

i) Casings shall be furnished with integral flanged suction and discharge nozzles. Flanges shall conform to ANSI standards. However, if the manufacturer's standard pattern offers a flanged thickness and diameter greater than that of the rating specified, the heavier flange may be furnished, but it shall be faced and drilled as specified.

ii) All pumps, compressors, and blowers shall be provided with a low point drain connection.

iii) Flange bolt holes shall straddle the horizontal and vertical centerlines.

iv) All vent, lantern ring, case drain, or seal re-circulation connections on pumps shall be 1/2-inch NPT minimum.

vi) Casing shall be provided with suitable means to facilitate disassembly of gasket joints, such as eye bolts, lugs, jack screws, etc.

vii) The stress used in design for any given materials shall not be in excess of the values given in Section VIII, "Unfired Pressure Vessel", of the ASME Boiler and Pressure Vessel Code, for the same material. For cast materials, the factor specified in the code shall be applied.

Auxiliary Piping:

i) When required, cooling water, gland oil, lube oil, and re- circulating piping systems, including all accessories, such as gauges and valves, shall be furnished by the vendor fully assembled and installed on the equipment.

ii) The piping shall be designed and arranged to permit ease of maintenance, and shall be properly supported to prevent vibration and damage. The temperature and pressure rating of the auxiliary piping handling process fluid shall be not less than the equipment maximum allowable casing working pressure at the maximum operating temperature.

iii) Piping threads shall be taper pipe threads conforming with ANSI standards. Tapped openings for pipe threads shall conform with the ANSI for steel pipe flanges and flanged fittings.

iv) Cooling water or steam jackets (housings) shall be designed for not less than 75 psig working pressure.

Correction Factor:

The correction factors given in the latest edition of the "Standards of the Hydraulic Institute" shall be used for sizing pumps handling liquids more viscous than water.

c) Warranty

The complete pumping assembly shall be guaranteed for pressure, capacity, and power consumption at the specified design operating conditions, water NPSH, and satisfactory application in all respects to the operating conditions specified on the individual pump data sheet. Permissible variation from the specified performance is as follows:

	Guarantee Point	Shutoff
Differential-head, 0 to 500 feet	Minus 2 percent, plus 5 percent	Minus 10 percent, plus 10 percent
Differential-head, over 500 feet	Minus 2 percent, plus 3 percent	Minus 8 percent, plus 8 percent
Efficiency	Minus ½ point of efficiency	
Brake horsepower	Plus 4 percent	
Required NPSH	Plus 0 percent	

d) Submittals

Provide the following information in addition to the standard requirements:

The following information is required with the Bid:

a) Pumps:

i) Preliminary outline dimension drawings.

ii) Pump performance curves which include differential head, efficiency, water NPSHR, and brake horsepower, all expressed as functions of capacity. These curves shall be extended to at least 125 percent of capacity at peak efficiency.

iii) Head-capacity curve for maximum diameter impeller(s) shall be shown.

iv) Manufacturers' published performance test curves are acceptable, except when viscosity correction factors are used. When applicable, manufacturer shall state viscosity correction factors used to determine corrected head capacity and efficiency.

v) The eye area of the first-stage impeller and impeller identification number shall also be noted on the curve.

b) Drawings and data within 4 weeks of award of contract:

i) Certified test curves shall be drawn from actual test data obtained from the purchased equipment and shall include discharge head or pressure, BHP (recalculated to proper specific gravity), and efficiency plotted against capacity.

ii) For pumps, the curve shall include the maximum and minimum diameters or the impeller supplied eye area of the first stage impeller, identification number of the impeller, and pump serial number. Viscosity corrections, if applicable, shall be indicated.

iii) Complete list of reference drawings, including those of the driver and controls.

iv) Cross-sectional or assembly type drawings showing all parts and construction features shall be supplied for all equipment. "Typical" drawings will not be acceptable.

v) Supply a list of any fits, clearances, and balancing data needed for maintenance, repair, and assembly.

The Contractor shall install primary, secondary chilled water & condenser water pump sets of specified capacity as shown in the drawings. All pumps shall be fitted with mechanical seal. The equipment supplied shall comply with the latest applicable Indian, American, British or equivalent standards. Pumps supplied shall run smooth without undue noise or vibration. The noise level shall be limited to 74 DBA at a distance of 1.8 M. Vibration shall limited to class IIC of BS 4675 part I.

DESIGN REQUIREMENTS

The power ratings of the pump motor shall be larger of the following:

- The maximum power required by the pump from zero discharge to zero head.
- 110% of the power required at the duty point.

Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.

CONSTRUCTION

The Chilled Water Pump Sets shall be back-pull out design fitted & shall be of cast iron construction. The pump shall be complete with ribbed cast iron casing, double shrouded single entry radial flow bronze impeller, mechanical seal, bearing bracket incorporating 2 nos. roller bearings, shaft, coupling, coupling guard, flanged connections for discharge and suction, purge /air vent/test cocks, etc.

The pumps shall be of direct driven by TEFC squirrel cage induction motors. The speed of the pumps shall not exceed 1400 RPM.
Pump shall be provided with renewable type casing ring. Bearing shall be grease lubricated and shall have a minimum life of 40,000 hours of working.

Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing box. Stuffing box shall be of such design that it can be repacked without removing any part other than the gland and lantern ring.

Mechanical seals shall be provided for all pumps. If required, a flushing line shall be furnished, complete with strainer and orifice, from the pump discharge to the sealing face.

All pumps shall be provided with spacer type couplings.

TESTS AND INSPECTION

Hydrostatic Testing:

i) Each pressure casing shall be hydrostatically tested with water at ambient temperature. The minimum test pressure shall be 1 1/2 times the rated maximum allowable casing pressure.

ii) Cooling water jackets shall be hydrostatically tested at 115 psig minimum.

iii) All hydrostatic tests shall be maintained for a minimum period of 30 minutes. Repair any leaks. Certification of test results is required.

PERFORMANCE TESTS

A. Standard Running Test

i) Pumps with drivers over 50 hp shall be given a performance test on water.

ii) Test speeds shall be at the rated speed of the pump, as shown on the individual pump data sheet.

iii) Certified test curves are required. Curves shall be drawn from the test data obtained for the purchased pump and shall include, head, efficiency, and BHP recalculated to the proper specific gravity plotted against capacity.

iv) Each pump that is given a performance test shall be checked for acceptable vibration limits during the factory running and performance test.

v) Mechanical seals shall be used during the running tests but are not required for the hydrostatic test.

B. NPSH Tests

i) An NPSH test shall be provided when the NPSH available indicated on the pump data sheet does not exceed the NPSH required by the pump by at least 1 foot.

ii) Suppression tests shall be carried out in a closed loop as described in the Standards of the Hydraulic Institute. Alternative methods may be acceptable when mutually agreed prior to placement of the Purchase Order.

C. Mechanical Balancing

In addition to static balancing, impeller and balancing drum shall be balanced dynamically at or near the operating speed.

D. Field Testing

After Installation, the pumps shall be subjected to testing at site also. If the field performance is found not to meet the requirements regarding vibration and noise as specified, the equipment shall be rectified or replaced by Contractor, at no extra cost to the Clients.

INSTALLATION

The pumps shall be installed on inertia bases as per the manufacturer recommendations. The pump sets shall be installed by competent personnel on a floating foundation with suitable vibration isolators.

The Contractor shall make the concrete foundations in accordance with manufacturer's drawings & recommendations. The Contractor shall supply isolation pads & stainless steel or hot dip galvanized foundation bolts along with the concrete foundation.

The bed plate levels and alignment shall be shown to the Consultant representative / Project managers before bolting and grouting the pumps to the foundation.

Cori-rubber make metallic bellows shall be provided at the suction and discharge connections of all pump-sets.

Pressure gauges and other accessories shall be provided as per the drawings. All fitments for gauges, thermometers and similar items must extend a minimum of 25 mm beyond outside the insulation to minimize the condensation problems.

A Run Test shall be conducted on one pump of each size. The following measurements shall be made during the test.

- Discharge Vs. Head
- Discharge Vs. Efficiency
- Discharge Vs. BHP
- Hydraulic test for casing at 1.5 times the design pressure.
- Vibration Level
- Noise Level

Quality Assurance

- The pumping package shall be assembled by the pump manufacturer. An assembler of pumping systems not actively engaged in the design and construction of centrifugal pumps shall not be considered a pump manufacturer. The manufacturer shall assume "Unit Responsibility" for the complete pumping package. Unit responsibility shall be defined as responsibility for interface and successful operation of all systems components supplied by the pumping system manufacturer.

- The local supplier of chilled water variable speed pumping system must have relevant expertise in all aspects of design, application engineering, installation, programming, interfacing, commissioning and after sales service. Supplier must have, as a minimum, commissioned 25 sets of chilled water VSPS in India.

- All functions of the variable speed pump control system shall be tested at the factory prior to shipment. This test shall be conducted with motors connected to AFD output and it shall test all inputs, outputs and program execution specific to this application.

- The manufacturer shall be fully certified by the international standards organization per ISO 9001. Proof of this certification shall be furnished at the time of submittal.

- Bidders shall comply with all sections of this specification relating to packaged pumping systems. Any deviations from this specification shall be bid as a voluntary alternate clearly defined in writing. If no exceptions are noted, the supplier or contractor shall be bound by these specifications.

3.0 AIR HANDLING UNITS

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DOUBLE SKIN AIR HANDLING UNITS

SCOPE

This specification covers the general design, materials, construction features, manufacture, shop inspection and testing at manufacturers works, delivery at site, handling at site, installation, testing, commissioning and carrying out performance test at site of Air Handling Units. **(AHU).**

Codes & Standards

The design, materials, manufacture, inspection, testing and performance of the Horizontal / Vertical AHU's shall comply with all currently applicable statutes, regulations, codes and standards in the locality where the equipment is to be installed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility. In particular, the AHU's shall confirm to the latest edition of the following standards:

IS 7613 Methods of Testing panel type Air Filters for Air-Conditioning and Ventilation purposes.

ASHRAE 33 Methods of testing – Forced Circulation Air Cooling and Air Heating Coils

ARI 410 Forced circulation air –air cooling and air heating coils.

ARI 430 Central-station air handling units.

AMCA 210 Laboratory methods of testing fans for ratings.

NFPA 90 A Installation of Air-Conditioning and Ventilation Systems.

GENERAL

a) Design Criteria

i) All fans shall be rated, tested, and certified in accordance with AMCA standards.

ii) All coils shall be rated, tested, and certified in accordance with ARI standards.

iii) Use dielectric unions or flange kits for dissimilar metal connections capable of galvanic corrosion.

iv) Buna-N seals are not allowed on hot water systems, use EPDM or Viton.

v) Filters shall be tested and certified in accordance with AHSRAE Standard 52.

vi) Units shall be designed in accordance with site seismic requirements.

vii) All instrumentation and controls shall be commercial quality.

b) Submittals

In addition to the standard requirements, provide the following with the Bid:

i) Estimates of inlet and outlet sound power levels (in dB re 10(-12) watt) in each octave band from 63 Hz to 4,000 Hz. These estimates shall take into account the attenuation provided by the cabinet of the air handler, which shall be acoustically lined as described in this Specification.

ii) Provide fan performance curves showing static pressure, rpm, and motor horsepower requirements versus air quantity handled over full range of fan capacity.

iii) Complete ARI-certified performance data at standard design conditions for all coils with performance at actual site conditions listed on the data sheets. Complete coil dimensional data and installation requirements.

iv) Data for each filter type: Complete certified performance data at design conditions, including volumetric flow rate and air pressure drop.

v) Seismic design calculations shall be submitted and certified with Bid.

vi) Provide proposed tie-down details with equipment submittals.

c) Factory Vibration Balance Report:

i) Certificate of compliance papers shall be attached to each fan at shipment, and signed by the fan manufacturer's quality control inspector. An additional copy shall be sent to Client / Project Managers.

ii) All factory balancing test results shall be furnished to certify the fan vibration does not exceed 50 mils per second rms for belt-driven units. Measurements shall be taken in a direction parallel to the shaft in a horizontal plane, and in a direction perpendicular to the shaft in both the horizontal and the vertical planes.

iii) During balancing tests, the fan shall be operating at rated volume flow against the design external static pressure.

The scope of this section comprises of supply and installation of Double skin cabinet type Air handling unit with all its accessories conforming to this specification and in accordance with the relevant drawings.

The Air handling units shall be constructed using double-skinned acoustic panels with minimum 0.8 mm thick pre-coated GSS sheet for outer skin and & 1.0 mm plain GSS sheet for inner skin of the unit. All the panels shall incorporate 25 mm thick PUF insulation of density 48 Kg / cum and K factor not exceeding 0.02 W/ M deg C sandwiched in between inner & outer skin; the inner skins can be of perforated sheet in the case of Fan Sections to bring down the noise level.

The entire frame work shall be mounted on a 100 mm (minimum) aluminum alloy channel base. The panels shall be sealed to the frame work by heavy duty "O" ring neoprene gaskets held captive in the framed extrusion. All panels shall be detachable or hinged. Hinges shall be made of die cast aluminium with stainless steel pivots. Handles shall be made of hard nylon and operational from both inside and outside of the unit. Units supplied with various sections shall be suitable for on-site assembly match drilled, with bolts, nuts and continuous neoprene rubber gaskets. All fixing and gaskets shall be concealed.

AHU's shall have hinged quick opening insulated access door on fan and filter sections. Access doors shall be double skin type and shall have same construction as the wall panels.

Four (4) lifting lugs shall be bolted to each base section for lifting or placing the AHU in place.

All connecting fasteners and related hardware and its accessories shall be in stainless steel.

The air handling unit's capacities, fan motor HP, fan static pressure & all other details are furnished in the equipment schedule & relevant drawings.

All the panels shall be assembled on a supporting frame of anodized hollow aluminum sections. Panel - to - frame joints shall be provided with EPDM Gaskets. Only stain less steel screws shall be used for fastening panels to the supporting frame. The inside of the unit shall have clear surfaces free from bolt & bolt - head projections.

The entire unit shall be of sturdy construction to ensure freedom from vibration while running. All sections shall incorporate access doors / panels. The hinges shall be of cast aluminum handles shall be of pressed steel. Self - lubricated Nylon sleeves shall be provided. The entire housing shall be mounted on extruded aluminum channel framework having pressure die cast aluminum jointers. All access doors, coil connections etc. Shall be provided on one side of the unit. In other words, access to the other side of the unit should not be necessary for any purpose what so ever.

Special care shall be taken to ensure that doors, handles, hinges, etc. shall be robust enough to with stand heavy industrial usage. The vibration of the AHU fans (as measured on the bearing block after assembly) shall not exceed a peak-to-peak displacement of 100 microns. For all AHU's, serrated rubber pads shall be provided for vibration isolation.

Casing shall be of air-tight construction and sufficiency rigid to exclude vibrations, e throughout the working capacity range of AHU.

COMPONENTS OF THE AIR HANDLING UNITS

The Air Handling Units shall consist of the following sections

A) Components

a) Filter Section with Pre-filter of efficiency 90% down to 10 Microns by Gravimetric test (EU-3 or better).
b) Chilled Water Cooling Coil Section
c) Fan Section (Should be AMCA Certified)

B) Accessories

a) 1 Set of Vibration Isolators (Rubber Pads) for each Air Handling Units.
b) Canvas Cloth shall be provided at the outlet of the Fan section in the Air Handling Units.
c) 1 set of Spare Filters apart from Commissioning filters fixed in the Each AHU

C) Spares To Be Included along with each AHU's

a) Refer Essential Spares in the document.

D) Documentation

a) 6 sets of technical documentation such as electrical schematics, cooling schematics, installation, operation & maintenance manual and spare part list in English Language to be included in the part of scope.

FAN SECTION

Fans shall have AMCA certification. The ratings which are to be submitted along with the proposal shall be based on the tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of AMCA certified ratings program.

The fan shall be of **Backward curved** of no overloading characteristics, double inlet double width type (DIDW). The wheel and housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy-duty ball bearings. Bearings shall be self-aligning; pillow block type selected for an average life of 200,000 hours at design operating conditions and shall be provided with grease line extending to outside of the AHU Casing. The impeller & blades shall be selected / designed for quiet - running. The fan assembly shall be statically & dynamically balanced. A single impeller for the entire flow rate specified for the unit is preferred. The bearings shall be mounted on the scroll. Fan shall be driven by or internally unit-mounted motor connected to fan by V-belt drive. Access panel for easy belt change

shall be provided for internally mounted motors. Belt connected motor capacity and shall adjustable to provide not less than ± 20% speed variation.

The fan & fan motor shall be assembled on a common frame, which shall be mounted on the floor of the casing with spring vibration isolators. The fan outlet shall be connected to the casing with fire retardant fabric acting as a flexile connection to avoid any vibration from the unit on to the ducts. Th**e fan outlet velocity shall not exceed 10 meters / second.** Fan motor shall be totally enclosed fan-cooled type and shall be suitable for 415 V/3 Ph / 50 Hz. Motor shall be sized to provide the additional power requirements when the fan is operated to provide an additional 20% of the rated capacity. The fan shall be selected for a noise level less than 65 dB.

MOTOR & DRIVE

Fan motors shall be suitable for 415 volts, 50 cycles, 3-phase, squirrel - cage, totally enclosed fan cooled with IP-55 protection. Motor shall be selected for quite operation and the speed of the motor shall not exceed 1400 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall of the oil-resistant type. Fan motor shall be suitable for variable speed by variable frequency drive application. (Motor should be part of scope with manufacturer & should not be supplied separately by ACMV Contractor)

CHW COIL SECTION & MOISTURE ELIMINATOR

The coil section of the AHU shall be of the cartridge type, removable from the side of the casing and supported over the entire length of the coil. The Cooling coil section shall have 12.5 mm to 15 mm dia copper tubes minimum of 24 G thick sine wave **aluminium fins** firmly bonded to copper tubes assembled in zinc coated steel frame. Face and surface area shall be such as to ensure rated capacity from each unit and such that air velocity across each coil shall not exceed 2.4 m/sec. Where required, eliminator shall be provided down stream of the cooling coil to arrest entrained free moisture from the air stream. An appropriate panel of the Coil Section shall incorporate factory made openings for coil inlet & outlet connections. The coils shall be mounted over an adequately sized condensate drain pan. Particular, care shall be taken to ensure that condensate is drained totally without leaving any stagnant pools any where in the unit. Each coil shall be factory tested under water. Tube shall be hydraulically expanded for minimum thermal contact resistance with fins. Fin spacing shall be 11 to 13 fins per inch. The Coil shall be mounted on castors to facilitate removal for cleaning. Flanges of resilient isolation material shall be provided both at the inlet and outlet connections of all cooling coils with necessary bushes of similar material to minimize transmission of vibration to connected piping. Coil shall have automatic air vents, the vent outlets beings piped to the drain pan with a copper pipe. Coil performance shall be rated in accordance with ARI Standard 410. Each coil shall be leak tested at 17 bars.

Moisture eliminator should be fitted after the cooling coil / humidifier section to avoid carry over of moisture. Eliminator blades are made of stainless steel and are assembled within in a heavy gauge galvanized steel frame. The Cooling Coil should be AHRI certified.

FILTER SECTION

The Filter Section shall consist of Pre-filters

The Pre filters shall have an efficiency of 90% down to 10 microns by Gravimetric Test (EU 3 or better) as per BS EN 779. The filter Pressure drop shall not exceed 6 mm wg when clean and 10 mm wg when fully loaded. Each unit shall be provided with a factory assembled filter sections containing washable synthetic type air filters having GSS frame. The media shall be supported with High Density Polyethylene (HDPE) mesh on one side and aluminum on the other side. Filter banks shall be easily accessible and designed for easy withdrawal and replacement of filter cells. Filter banks frame work shall be fully sealed and constructed from GSS.

DRAIN PAN

The Insulated drain pan shall be constructed using stainless steel of 18 G with necessary slope to facilitate fast removal of condensate. Necessary arrangement shall be provided to slide the coil in the drain pan. The outlet of the condensate discharge shall of 32mm in dia.

SAFETY FEAUTRES

Each Air Handling unit shall have safety features as described below, but not limited to those listed below:

The fan access door shall be equipped with micro-switch inter locked with fan motor to enable switching off the fan motor automatically in the event of door opening. The access door shall be further having wire mesh screen as an added safety feature bolted on to the unit frame.

Fan and motor base shall be properly earthen from the factory.
All screws used for panel fixing, projecting inside the unit shall be covered with PVC caps to avoid human injury.

Air handling units shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data, with operating points clearly indicating shall be submitted and verified at the time of testing & commissioning of the installation.

ACCESSORIES

All the accessories shown in the drawings as indicated shall be included. Each air-handling unit shall be provided with manual air vent at high point in the cooling coil and drain plug at the bottom of the coil.

Inspection Window
Bulkhead lightning.

LIGHTING INSIDE THE AIR HANDLER

Revision elements for fan- and filter components must be equipped with interior lighting.
Interior lighting must be wet room execution, with a 40 W/ 230 V lamp, terminal box and switch mounted on the unit's outside, wired and ready for operation.

PERFORMANCE DATA

Air handling units shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data, with operating points clearly indicating shall be submitted and verified at the time of commissioning of the equipment.

TESTING, ADJUSTING & BALANCING

Cooling capacity of various air handling unit models shall be computed from the measurements of airflow and dry & wet bulb temperature instruments. An anemometer and the butterfly shall do flow measurement / ball valves shall be adjusted as per the piping flow diagram. The Contractor is responsible in all the respects to balance the whole system. Computed results shall confirm to the specified capacities and quoted ratings. Power consumption shall be computed from measurement of incoming voltage and input current.

FACTORY TESTS

The Contractor / manufacturer shall describe the tests that will be conducted at their works on the Air Handling Units. They shall furnish a test certificate / certificates to the effect that such tests have been duly performed on the AHU's.

Tests shall be conducted on all AHU's at the factory for measurement of delivery vs. static Pressure, total pressure, BKW, efficiency & noise level at 100%, 80% 60%, 50% & 40% speeds. The Consultants / Project managers / Architects shall be intimated in advance of the date of the tests, which they will witness at their option.

IMPORTANT NOTE

All spares, filters, plenum with outlets having dampers, 50 Hz motors, variable frequency drives etc should be part of manufacturer & should not be separated & locally procured from other agencies.

Execution

Field Quality Control

i) Manufacturer's Startup Services:

A manufacturer's representative for the fans shall be provided as necessary to assist the Subcontractor during installation, and to provide written certification that the equipment has been installed complete as specified and in accordance with the manufacturer's directions as approved.

All fan equipment shall be verified by field vibration tests that factory balance has been maintained during shipment and erection. Field rebalances if required.

After the fan is operating normally, provide instructional time with Client's personnel to review the maintenance manuals and perform each step necessary for startup, shutdown, troubleshooting, and routine maintenance. This service orientation shall be scheduled through the Contractor so that he may observe the training sessions.

Upon completion of the inspections, startup, testing, and checkout procedures, the fan manufacturer shall submit written notice to Contractor that the units are ready for beneficial use by Client. In order to establish the minimum service requirements, a manufacturer's representative for the equipment specified herein shall be present at the jobsite for the following: Installation assistance, inspection, and certification of the installation for each unit.

For plant startup and maintenance instructional time for each air-handling unit.

All instruments are to be calibrated at the supplier's factory. A calibration sheet for each instrument shall be supplied showing the calibration range and date calibrated.

Allow time at the factory for others to perform an acceptance test and inspection on the controls supplied and installed

DATA TO BE FURNISHED BY THE CONTRACTOR AFTER THE AWARD OF CONTRACT

a) Schedule of drawings and documents to be submitted for review, approval and information with submission dates.

b) Quality assurance plan (QAP).

c) Detailed P&I diagram showing clearly the scope of supply of equipment, piping with line sizes and material specifications, valves, specialties, instrumentation and control and all accessories. This drawing or documents mentioned under following clauses shall include all design data and information furnished in technical data sheets. The makes of all major components and control shall be indicated.

d) Dimensioned general arrangement drawing showing all equipment with accessories, mounting details, nozzle locations etc.,

e) Overall space and head room requirement with details of handling during erection, operation and maintenance.

f) Foundation drawing with static and dynamic loading data, pocket details, foundation outline etc., for all items.

g) Cross sectional drawings of all items with part list and materials of construction.

h) Performance curves and selection chart for fan, filters etc., Selection charts and calculations for cooling coil and heating coil.

i) Operation & maintenance manual with lubrication schedule.

j) Catalogues furnishing detailed technical data for fan, coils, filters etc.

6.0 PIPING AND VALVES

PIPING

GENERAL

The scope of this section comprises the supply and laying, testing and balancing of all piping works like chilled water piping, condenser water piping, drain piping and allied works like fixing of valves and other accessories involved in this project. All piping inclusive of fittings and valves shall follow the applicable Indian Standards. The attached drawings shows the general layout of the piping.

MATERIAL

Pipe sizes shall be as required for the individual fluid flows. Various pipe sizes have been indicated on the Drawings, these are for Contractor's guidance only and shall not relieve contractor of responsibility for providing smooth noiseless balanced circulation of fluids.

All chilled water shall be of MS ERW tube, "**B- class"** and shall conform to IS Standards & joints shall be welded.

All piping 200 mm dia. and over, shall be fabricated using MS plates of thickness indicated below:

Pipe dia – mm	**Thickness - mm**
200 mm	**5 mm**
250 & 300 mm	**6 mm**
300 & up to 600 mm	**8 mm**

All Drain Piping shall be of GI pipe insulated with Nitrile rubber .

Where GI pipe is cut, threaded or welded, it shall be painted with 2 coats of zinc paint both internally and externally over a coat of red-oxide primer.

CHILLED WATER PIPING

a. All chilled water and condensing water pipes and all fittings shall be Mild Steel (MS) Class `B' (Medium Class) conforming to relevant BIS-1239 Code. Factory rolled pipes between 300 mm to 600 mm diameter shall have 8 mm wall thickness. All jointing in the pipe system shall generally be by welding, unless otherwise mentioned, or directed at site. All welding shall be done by qualified welders and shall strictly conform to BIS Code of practice for manual metal arc, welding of Mild Steel.

First butt weld of each welder shall be fully radio graphed for testing purposes. Upon approval of welding joints the concerned welder shall be allowed to carry further welding of pipes. Rest of the welds shall have 100% visual inspection.

a. All welded joints (except pipe welded end-to-end) shall be made by use of forged one-piece welding flanges, caps, nozzles, elbows, branch outlets and tees of approved make. Cut samples shall be submitted or approval, if directed. All such fittings etc. shall be of a type, which maintain full wall-thickness at all points, simple radius and fillets, and proper bevels or shoulders at ends. All welded piping (particularly piping in concealed locations) shall be subject to the approval of Consultants/Project Managers, before the work is closed. All job welding shall be done by the electric arc welding process in accordance with the following:

* The ends of pipe lengths to be welded shall be cut square by saw or cutter and the edges beveled to form a 'V' groove before welding and All joints shall have 45-degree bevel type, pipe mill-beveled or machine-beveled by the contractor.
* All scale and oxide shall be removed with hammer, chisel or file and bevel left smooth and clean.
* Pipe lengths shall line up straight with abutting pipe ends concentric.
* Both conductors from the welding machine shall be extended to locations at which welding work is being done. The leads from welding machine to location of welding work shall be held together with tape or other approved means so as to prevent induced current in structural steel, in piping or in other metals within the building. The ground lead shall be connected to length of pipe through joints in pipe, structural steel of building or steel pipe supports.

c. All pipes and their steel supports shall be thoroughly cleaned and given one primary coat of red oxide paint before being installed. For vibration isolators pre-moulded polyurethane pipe sections of 160 Kg/m^3 density with adhesive shall be fixed between pipe and MS support. 10 mm thick MS 'U' clamp with resist flex shall be fixed on the pipe so that the pipe is kept in position. All welded piping shall be subject to the approval at site.

d. Fittings shall be malleable casting of pressure rating suitable for the piping system. Fittings used on welded piping shall be of the wieldable type. These shall form part of piping and are not separately identified in Schedule of Quantities.

e. Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.

PIPING INSTALLATION

a. Design Drawings indicate schematically the size and location of pipes. The Contractor, on award of the work, shall prepare detailed shop drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in the building through which pipes are designed to pass.

b. Overhead piping shall be supported on walls/columns appropriately with brackets or hung from ceiling /roof slabs and rolled steel sections of the roof structure with Flam co supports. Suspenders shall be fastened to the roof/ceiling slab with Anchor grip bolts; similarly, Anchor grip bolts –where required - shall be used for fixing wall brackets also. The contractor shall design adequately all brackets, saddles, clamps, hangers, etc., and be responsible for structural safety and integrity. Further, while providing the supports, care shall be taken to ensure freedom from vibration.

All supporting arrangements including necessary suspenders, brackets, rods, bolts and nuts, etc. and all civil work related thereto - including drilling of holes for fixing grip bolts and any chipping and finishing, shall be included within the scope of the work of the contractor and shall be carried out under the scope of HVAC system.

c. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint and finish coated black. Where pipe and clamps are of dissimilar materials, a gasket shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe size	Spacing between supports	Rod Size
Upto 12 mm	2.5 Meter	08 mm
15 to 25 mm	2.0 meter	10 mm
30 to 150 mm	2.0 meter	12 mm
Over 150 mm	2.5 meter	with Angle/Channel supports

d. Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars attached to pipes and transmitting the load to the structure through 12 mm (1/2 ins.) thick rubber pad or any suitable resilient material. MS cleats shall be welded on pipes and rest on MS channel placed on the floor with 15 mm thick resistoflex pads between the cleat and channel. U clamps with resistoflex sheet shall be provided to keep the pipe in position. Where pipes pass through terrace floor, suitable flashing shall be provided to prevent leakage. Risers shall also have a suitable elbow or concrete pipe support at the lowest point.

e. Bull heading in water/refrigerant piping shall be avoided.

f. Pipe sleeves at least 3 mm thick, 50 mm / 100 mm larger in diameter than condenser / chilled water pipes respectively shall be provided wherever pipes pass through retaining wall and slab. Annular space shall be filled with felt and finished with retaining rings to isolate any vibrations from being transmitted to walls/structures.

g. Wherever pipes pass through the brick or masonry / slab openings, the gaps shall be sealed with **fire sealant** such as fire barrier caulks.

h. Insulated piping (where not covered with aluminium cladding) shall be supported in such a manner as not to put undue pressure on the insulation. 14G GSS shall be provided between the insulation and the clamp, the saddle or roller extending at least 50 mm on the either side (of the clamp, saddle or roller). The method of support shall be approved by the **Consultants / Project Managers.**

j. All piping work shall be carried out in a workmen like manner, causing minimum disturbance to the existing services, buildings and structure. The entire piping work shall be organized, in consultation with other agencies work, so that laying of pipes, supports, and pressure testing for each area shall be carried out in one stretch.

k. Cut-outs in the floor slabs for installing the various pipes are indicated in the Drawings. Contractor shall carefully examine the cutouts provided and clearly point out where the cutouts shown in the Drawings do not meet with the requirements.

l. The Contractor shall make sure that the clamps, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

m. All pipes shall be accurately cut to the required size in accordance with relevant BIS Codes, edges beveled and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.

n. Flanged inspection pieces 1.5 meters long, with bolted flanges on both ends, shall be provided no more than 30 meters centers, or where-ever shown in Approved-for-Construction shop drawings, to facilitate future cleaning of all welded pipes.

o. All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters and wrapped with three layers of fiber glass tissue, each layer laid in bitumen.

p. Insulated buried pipes shall be cleaned, de-rusted, then coated with rust-resistant primer and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters. Insulation shall be applied as per the section "Insulation", wrapped with GI wire and covered with polyethylene sheet. Two coats (each 6 mm thick) of cement plaster shall be applied over chicken wire mesh lath. Where indicated in Schedule of Quantities, buried insulated pipes shall be water-proofed using coat of Shalibond, or approved adhesive, over the plastered surface; wrapping one layer of fiber glass RP tissue and one layer of roofing tar felt with sufficient overlaps, set and sealed with the adhesive, held in position by 16 gage G.I wire tied at 15 cm intervals.

q. Auto purge valves shall be provided at all highest points in the piping system for venting air. Air valves shall be 15 mm pipe size with screwed joints. Discharge from the air valves shall be piped through an equal sized mild steel or galvanized steel pipe to the nearest drain or sump. These pipes shall be pitched towards drain points.

DRAIN POINTS

The Drain shall be provided at the low points in the piping system for maintenance. Gate valves shall be provided in the drain line as shown in the drawings.
The size of the drain piping shall be as follows:-

Main chilled water Header size – mm	**Drain –mm**
Up to 300 mm	25 mm
Over 300 mm	40 mm

Drain shall be provided with gate valves of equal size but with rising spindle. Drains shall be piped through equal size G.I. pipe to the nearest drain or floor waste or as shown in drawings. Piping shall be pitched towards drain points.

CONDENSATE WATER DRAIN PIPING

a. All pipes to be used for cold water (makeup), drain, and condensate drain and fittings shall be **galvanized steel class `B' (medium class)** conforming to relevant BIS Codes.

b. All jointing in the pipe system shall be by screwed joints and/or by screwed flanges using 3 mm 3 ply rubber insertion gaskets. Pipe threads and flanges shall be as per relevant BIS Codes.

c. All pipes supports shall be mild steel, thoroughly cleaned and given one primary coat of red oxide paint before being installed.

d. Fittings shall be galvanized steel `medium class' malleable casting of pressure rating suitable for the piping system. Flanges shall be of approved make. Supply of flanges shall include bolts, nuts, and gaskets as required. Sufficient number of flanges and unions shall be provided for future cleaning and servicing of piping. Tee-off connection shall be through equal or reducing tees. All equipment and valve connections, or connections to any other mating pipes shall be through flanges required for the mating connections. Fittings & flanges shall form part of piping and are not separately identified in Schedule of Quantities.

e. Gate valves, globe valves, check valves and strainers shall be similar to those specified for chilled, condensing and hot water piping.

f. For proper drainage of AHU Condensate, 'U' trap shall be provided in the drain piping.

g. All condensate drain piping shall be insulated and painted as per the section "Insulation" as indicated in Schedule of Quantities.

TESTING

a. During construction, the contractor shall properly cap all lines, so as to prevent the entrance of sand, dirt, etc. Each system of piping shall be flushed thoroughly after completion (for the purpose of removing dirt, grit, sand etc. from the piping and fittings) for as long a time as is required to thoroughly clean the system.

b. All piping shall be tested to hydrostatic test pressure of at least two and half times the maximum operating pressure, but not less than 10 kg per sq. cm gage for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified, retested and gotten approved.

c. Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

d. Piping may be tested in sections and such sections shall be securely capped, then re-tested for the entire system.

e. 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.

f. The contractors shall provide temporary pipe connections to initially by-pass condenser/chiller and circulate water through condenser/chilled water pipe lines for minimum 8 hours. Water should be drained out from the lowest point. The temporary lines shall be removed and blanked with dead flanges. Pot strainers and Y strainers shall be cleaned and fresh water filled in the circuits.

g. 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 due to air bound connection, the Contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and re-finishing of floors and walls if required.

h. After the piping has been installed, tested and run for at least three days of eight hours each, all insulated exposed piping in plant room shall be given two finish coats, 3 mils each of approved color, conforming to relevant BIS Codes. The direction of flow of fluid in the pipes shall be visibly marked with identifying arrows. For painting of insulated and clad pipes refer to Insulation section.

j. After testing, all systems shall be chemically cleaned. After cleaning, the pipe work should be rinsed multiples times until the system is neutral.

Before handover Owner's site representative shall be provided with certificate of cleaning of pipe systems, signed by the contractor.

k. The Contractor shall provide all materials, tools, equipment, instruments, services and labor required to perform the test and to remove water resulting from cleaning and after testing.

BALANCING

a. After completion of the installation, all water system shall be adjusted and balanced to deliver the water quantities as specified, quoted, or as directed.

b. All balancing valves, Automatic control valves and two-way diverting valves shall be set for full flow condition during balancing procedure. Each water circuit shall be adjusted thru balancing valves provided for this purpose; these shall be permanently marked after balancing is completed, so that they can be restored to their correct positions, if disturbed.

c. Complete certified balancing report shall be submitted for evaluation and approval by Owner's site representative. Upon approval, four copies of the balancing report shall be submitted with the as-installed drawings and completion documents.

MEASUREMENT FOR PIPING

Unless specified otherwise, measurement for piping for the project shall be on the basis of centerline measurements described herewith.

Piping shall be measured in units of length along the center line of installed pipes including all pipe fittings, flanges (with gaskets, nuts, and bolts for jointing), unions, bends, elbows, tees, concentric and / or eccentric reducers, inspection pieces, expansion loops etc. The above accessories shall be measured as part of piping length along the centerline of installed pipes, and no special multiples of pipe lengths for accessories shall be permitted.

The quoted rates for center line linear measurements of piping shall include all wastage allowances, pipe supports including hangers, MS channel, PUF supports, nuts, check nuts, vibration isolator suspension where specified or required, and any other item required to complete the piping installation as per the Specifications. None of these items will be separately measured nor paid for.

However, all valves (gate / globe / check / balancing / purge / butterfly / drain etc), strainers, thermometers, pressure gages shall be separately counted and paid as per their individual unit rates, which shall also include their insulation as per Specifications. Piping measurements shall be taken before application of the insulation.

Contractor shall get pressure testing of pipes/measurements etc verified by the Owners representative at site.

VALVES

SCOPE

This section deals with different type of valves like butterfly valves, gate valves, ball valves, check valves, balancing valves and Strainers. The contractor shall refer to the approved make of materials specified in the document & relevant drawings.

BUTTERFLY VALVES

Butterfly valves shall be of slim seal, short wafer type with standard finish. The valves shall be suitable for mounting between flanges drilled to ANSI 125. The valve body shall be cast iron. The disc shall consist of disc pivot and driving stem. The disc shall move in bearings on both ends with 'O' Ring to prevent leakage. The seat shall be molded black nitrial rubber or nylon. The valves shall be suitable for a working pressure of 16.0 kg/scm (PN 16) and shall be complete with flow control lever and notches, factory machined companion flanges, bolts & nuts.

GATE VALVES

All gate valves and check valves shall be of cast iron flanged type conforming to class 2 of IS 780/69 for sizes up to 350 mm and IS 2906/69 for sizes 350 mm & above. All such valves shall be supplied with I.S.I marking and certification.

BALL VALVES

Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends.

CHECK VALVES

Check valves shall be of Dual plate check valves with CI body, aluminium-bronze plates, SS 316 hinge pins, springs & Buna-N seals to ANSI series 125. The check valves shall be suitable for 210 psi (21 Kg/sqcm) test pressure with suitable for 15 Kg/cm2 operating pressure.

Check valves shall be of non-slamming type to prevent water hammer either by providing springs or accumulators. All check valves must be only vertical type.

STRAINERS

"Y" strainers up to 50 mm shall be of gunmetal and above 50 mm shall be of cast iron body. Strainers shall incorporate a removable bronze screen with 3mm perforations and a permanent magnet. Strainers shall be provided with flanges at both inlet and outlet of the chilled water pump set. They shall be designed to enable blowing out the accumulated dirt and facilitate removal / replacement of screen without disconnecting the main pipe.

FLANGES & UNIONS

Sufficient number of flanges and unions shall be provided as required to facilitate the maintenance work after the piping is installed. Mild steel ANSI 125 flanges shall be used for pipes of 65mm dia and above.

PRESSURE GAUGES

Pressure gauges shall be not less than 150 mm dia. They shall be selected for appropriate range and shall be complete with siphon and cock, etc.
Pressure gauges shall be provided at suction and at discharge of each pump, at chilled water supply and return at each air handling unit, at each chillers and condenser, and as shown on the Drawings and included in Schedule of Quantities. Care shall be taken to protect pressure gages during testing. Pressure gage sockets on insulated pipes and accessories shall be extended up to insulation to avoid damage of insulation for replacement of gages.

Pressure gauges shall be provided as shown in the drawings & as per price schedule.

THERMOMETERS

Thermometers shall be provided at chilled water supply and return at each air handling unit, at each chiller and condenser, and as shown on Drawings and included in Schedule of Quantities.

Thermometers on CHW lines shall be with long stem. Thermometer socket shall be extended up to insulation thickness so that the thermometer shall be removable without damaging the insulation.

AUTOMATIC AIR VENTS

It should be of compact & efficient design made of Brass construction to efficiently remove air pockets from hydraulic systems with a maximum working pressure of 4-6 bar & working temperature of 120 deg C.

FLEXIBLE CONNECTIONS

Flexible neoprene connectors shall be used on all equipment as indicated on drawings & on equipment schedule. They shall be manufactured in multiple ply's of nylon tire cord fabric and Neoprene both moulded & cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement.

The flexible connectors shall be provided at:
Inlet & Outlet of Chillers
Inlet & Outlet of Pumps
Inlet & Outlet of Cooling Towers

VALVE IDENTIFICATION

Provide 30 mm dia brass valve tag, with embossed letters and number for each valve and attach the tag to valve handle by "S" hook or by suitable means. Contractor shall provide valve tag schedule and valve chart for each piping system, consisting of schematic drawing of piping layout, along with a valve list, showing and identifying each valve by number, service and location and describing its function.

The contractor shall frame under glass in the air-conditioning plant room or as directed by Owner's site representative two copies of valve chart. Two additional un-mounted copies shall be supplied to the Owner's site representative.

Tags shall correspond with the valve schedule and record drawings. In back of house areas, where ceilings are installed and the valve or valve tag is not visible, a self-adhering tag with the valve number shall be installed on the wall or directly under the ceiling. For public area ceiling valves, these tags are to be installed in the service corridor, leading to the public areas.

All pipes shall have arrow marks to indicate the direction. Arrow shall be of radium sticker with navy blue colour. Condenser water piping after testing shall be given 2 coats of primer before final coat.

All exposed ducts and pipe supports shall be given 2 coats of paint after primer coating as directed by the Architect. The cost of painting shall be included in unit rate of pipes and ducts.

Sl. No.	**Services Flow Colour**
a.	Chillers Water Supply Sky Blue
b.	Chillers Water Return Cascade Green
c.	Pumps & Motors Dark Adm. Grey (28-105)
d.	Supports Black (28-122) Or As directed

e. Unit Cooler & AH Fiesta Blue Unit & Exposed (28-9104)

Note:
1) All colours and codes refer to ICI DULEX Synthetic Enamel Colours. nearest equivalent acceptable.
Distinguishing white bands in British white 28-100.

7.0 STANDARD SPECIFICATION OF ACOUSTIC INSULATION

This section deals with supply and fixing of **acoustic** insulation of ducts, pipes etc. as per the specification given in this section.

7.10 MATERIAL OF INSULATION

The insulation material of the following kind shall be used for cold insulation.

a) RESIN BONDED FIBRE GLASS WOOL

The Thermal conductivity values in W/m.K of fibreglass shall confirm to following:

Mean Temperature □C	**Density In Kg / Cmt.**	**Thermal Conductivity W/m.k**
For Duct Insulation		
25□Ç	24	0.033
50□Ç	24	0.039
For Duct Lining		
25□Ç	36	0.032
50□Ç	36	0.035

7.20 INSULATION ON SHEET METAL DUCTING

The thickness of insulation used on ducting shall be as detailed below:

	Conditioned space
a) Supply Air Duct	Insulated with 25 mm thick Aluminium faced Fiber Glass as shown in the tender drawing.
b) Return Air	Insulated with 25 mm thick Aluminium faced Fiber Glass in non AC areas as shown in the tender drawing.
c) Fresh Air Duct	Insulated with 25mm thick Aluminium faced Fiber Glass as shown in the tender drawing.
d) Plenums	Lined internally with 25mm thick fiber glass of density 32 Kg / m^3 as shown in the tender drawing
e) Supply Air Duct Collars & FCU Collars board	Lined internally with 12 mm thick fiber glass rigid of density 48Kg / m^3 as shown in the tender drawing

The application of insulation should be carried out in workman like manner as detailed below.

7.21 INSULATION OF DUCTING WITH ALUMINIUM FACSD FIBRE GLASS

a) Duct surface to be cleaned thoroughly

b) To apply two coats of CRPX compound.

c) To fix factory pre-laminated Aluminium faced fiber glass insulation of density 24 Kg/ m ^{3} of specified thickness.

d) Fix self-adhesive aluminum tape of 50 mm width on all longitudinal / transverse joints.

e) Finally fix PVC straps of 19mm width at every 300mm centre to centre.

7.22 ACOUSTIC LINING OF DUCT.

The material to be used for duct lining shall be 25mm thick resin bonded fibre glass having a density of 32 Kg/m^3 or 12 mm thick fibre glass rigid board of density 48 Kg/m^3 & covered with 0.5 mm thick perforated aluminum sheet. The lining of initial length of the duct shall be done as shown in the tender layout drawings & shall be carried out as follows.

a) Clean the duct piece thoroughly,

b) Fix the fibre glass of suitable thickness inside the frame work & cover with fibre glass tissue paper.

c) Cover the insulation board with 0.5mm thick perforated Aluminium sheet with at least 20% to 25% perforations

d) Secure the Aluminium sheet with GI frame work with cadmium coated self taping screws with washers.

7.23 INSULATION OF PIPES

i. The Refrigerant pipes (Suction Line) shall be insulated with two layer of Nitrile Rubber insulation each of minimum 19mm Thick. To protect Nitrile rubber insulation of outdoor installed copper piping from degradation due to ultra violet rays and atmospheric condition, it shall be covered with polyshield coating of at least two coats of resin and hardener (poly bond make or equivalent). Fiberglass tape shall be helically wound with adequate overlap & coated with two coats of resin with hardener to give smooth & plain finish.

The Refrigerant pipe inside the Shaft should be insulated with Minimum 19 mm Thick Nitrile rubber in two layer with Aluminium cladding. The condensate drain water pipes shall be insulated with 9 mm thick Nitrile rubber insulation. The Condensate drain pipe should be hard PVC of Ori-plast of Equ. Make. The application of insulation on pipes should be carried out in workman like manner as mentioned below:

ii. All chilled water, refrigerant, and condensate drain piping shall be insulated in the manner specified herein. Before applying insulation, all pipe shall be brushed and cleaned. All MS pipes shall be provided with a coat of zinc chromate primer. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity:

Pipe size (mm)	Thickness of expanded polystyrene (TF Quality)mm
10 to 40	25
50 to 450	50
Above 450	100
20mm to 50mm	25 mm

Insulating material in tube form shall be sleeved on the pipes. On piping, slit opened tube from insulating material shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.

Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre. Wherever flat sheets shall be used it shall be cut out in correct dimension using correct tools. Scissors or Hacksaw-blade shall not be allowed. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. All longitudinal and transverse joints shall be sealed by providing 6 mm thick, 50 mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer. The insulation shall be continuous over the entire run of piping, fittings and valves. All valves, fittings, joints, strainers etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

Manufacturer's installation manual shall be submitted and followed for full compliance. All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (S.R. or R.R.) and provided with 300 mm wide band of paint along circumference at every 1200 mm for color coding. Direction of fluid shall also be marked. Un-insulated MS pipes shall be painted throughout and direction of fluid marked. All painting shall be as per relevant BIS codes.

7.24 PROTECTIVE COATING OVER INSULATION

To provide mechanical strength and protection from damage all pipe / duct insulated with nitrile rubber as indicated in BOQ shall be covered with fiberglass fabric of 7 mil minimum thickness.

Insulated pipes & ducts exposed to UV rays shall be covered with fiberglass fabric. Over fabric one coat of fire proof epoxy or acrylic compound shall be applied. The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface. Closed cell cross linked polyethylene foam shall be provided with factory laminated metalized film foil.

7.30 PUMP INSULATION

Chilled water pump shall be insulated to the same thickness as the pipe to which they are connected and application shall be same as above. Care shall be taken to apply insulation in a manner as to allow the dismantling of pumps without damaging the insulation.

7.40 SHELL INSULATION

The chiller shells shall be factory insulated in accordance with the manufacturer's standards.

7.50 COLD WATER AND EXPANSION TANK INSULATION

Cold water tank, and chilled water expansion tank shall be insulated as per manufacturer's standard.

7.60 ACOUSTIC LINING OF MECHANICAL ROOMS

Two walls and ceiling of air conditioning plant room and air handling unit rooms may be provided with acoustic lining of resin bonded fiberglass as per Schedule of Quantities and as shown on the Drawings. The surface shall be cleaned and frame work of 22 gage GI fabricated Channels 25 mm x 50 mm screwed back to back at 60 cm centers shall be provided vertically and horizontally so that 60 x 60 cm squares are formed. The gaps between frames shall be filled with 50 mm thick about 60 cm x 60 cm cut panels of resin bonded fiberglass slabs. The entire surface shall then be covered with fiberglass tissue and 26 gage perforated aluminum sheet, 60 cm or 120 cm wide having at least 15 percent perforations, fixed with sheet metal screws. Over-lapping of sheets shall be covered with Aluminum beading. Acoustic lining of walls shall be terminated approximately 15 cm above the finished floor to prevent damage to insulation due to accidental water-logging in plant/AHU rooms.

7.70 UNDERDECK INSULATION

Under deck insulation shall be 50mm thick TF Quality expanded polystyrene (32 Kg/m^3) or 30mm thick phenotherm. Under deck surface of ceiling shall be cleaned and made dirt free. Insulation panels shall be pasted on this surface with black CPRX compound. 28g wire net shall be tightened around insulation so as to avoid any kind of sagging. Ends of net shall be overlapping by at least 25mm. Overlaps shall be screwed with galvanized screws to avoid rusting.

7.24 INSULATION OF PIPES & FINISH WITH ALUMINIUM CLADDING (INSIDE THE SHAFT)

a) The pipe to be insulated should be cleaned thoroughly for removing dirt, and grease.

b) Apply a coat of SUITABLE adhesive on pipes.

c) Fix insulation of specified thickness tightly and seal all joints with adhesive compound.

d) Apply another layer of adhesive on the surface of the insulation and wrapped with another layer of nitrile rubber pipe section with over lapping longitudinal & transverse joints.

e) Wrapped a layer of polythene sheet and self adhesive tape for firm holding of polythene sheet in position at interval of 500 mm.

f) Finish the surface with 0.5 mm thick aluminium sheet fixed with the hand operated roller machine (Grooving Machine) & finally to be fixed with self tapping screws.

7.25 INSULATION OF PIPES (INSIDE ROOMS AND EXPPOSED TERRACE)

a) The pipe to be insulated should be cleaned thoroughly for removing dirt, and grease.

b) Apply a coat of SUITABLE adhesive on pipes.

c) Fix insulation of specified thickness tightly and seal all joints with adhesive compound.

d) Apply another layer of adhesive on the surface of the insulation and wrapped with another layer of nitrile rubber pipe section with over lapping longitudinal & transverse joints.

e) Covered with poly shield coating of at least two coats of resin and hardener (poly bond make or equivalent)

f) Fiberglass tape shall be helically wound with adequate overlap & coated with two coats of resin with hardener to give smooth & plain finish

STANDARD SPECIFICATION FOR AIR CIRCULATION SYSTEM

8.00 This section deals with supply, erection, testing & balancing of GI sheet metal duct work and air registers conforming to specifications as given below:

8.10 MATERIAL FOR DUCTING

The duct shall be fabricated out of galvanised sheet, class VIII (Zinc coating 120 gm/m²as per the parameters given below which are conforming to IS 655-1963.

MAXIMUM SIDE	**THICKNESS OF GI SHEET**	**TYPE OF TRANSVERSE JOINT CONNECTIONS**	**BRACING**
(1) mm	(2) mm	(3)	(4)
Up to 300	0.63	S-drive, pocket or bar Slips, on 2.5m centers	None
301 to 600	0.63	S-drive, pocket or bar slips, on 2.5m centers	None
601 to 750		S-drive, 25mm pocket or 25 mm bar slips on 2.5m centers.	25 x 25 x 3 mm angles, 1.2m from joint
751 to 1000	0.80	Drive, 25-mm pocket or 25mm bar slips, on 2.5 m centers 40 x 40 mm angle connections,	25 x 25 x 3 mm angles, 1.2 m from joint
1001 to 1500		or 40-mm bar slips, with 35 x 3 mm bar reinforcing on 2.5 m centers.	40 x 40 x 3 mm angles, 1.2 m from joints
1501 to 2250	1.00	40 x 40 mm angle Conn-ections, or 40-mm bar slips, 1 m maximum centers with 35 x 3 mm bar reinforcing .	40 x 40 x 3 mm diagonal angles, or 40 x 40 x 3 mm angle 60 cm from joint.
2250 to above*	1.25	50 x 50 mm angle connec-tions, or 40 mm pocket or 40 mm bar slips, 1 m max. centers with 35 x 3 mm bar reinforcing.	40 x 40 x 4 mm diagonal angles, or 40 x 40 x 3 mm angles, 60 cm From joint.

* Ducts 2250 mm and larger require special field study for hanging and supporting methods.

In addition to above the following points should be also taken into account while fabrication of ducts.

a) All ducts of size larger than 450mm shall be cross broken.

b) All ducts shall be supported from the ceiling / slab by means of MS rods of dia 9mm with MS angle of size 40 x 40 x 5 mm at the bottom with neoprene pad in between the duct & MS angle. The ducts shall be suspended from the ceiling with the help of dash fasteners. Provision for necessary ancillary materials required for hanging the ducts shall be arranged by the contractor.

c) The vanes shall be provided wherever required and shall be securely fastened to prevent noise & vibration.

d) The rubber gasket shall be installed between duct flanges in all connections and joints.

e) All flanges and supports should be primer coated.

f) The flexible joints shall be fitted to the delivery side of AHU fans with Fire Retardant Double canvass. The length of flexible joints should not be less than 150 mm and not more than 300 mm between FACSs.

g) The ducting work can be modified if deemed necessary in consultation with the Engineer in Charge to suit actual site conditions in the building.

h) **Box Type Dampers & Splitters**

These dampers shall be provided in the ducting work for proper control and balancing of air distribution. All dampers shall be louver type robust construction. These dampers shall be fitted with easily accessible operating mechanism, complete with links, levers, quadrant for proper control and setting in a desired position. The position of the handle of the damper operating mechanism shall be clearly variable and shall indicate the position of the damper in the duct. All dampers, splitters shall be fabricated out of G.S. sheet of two gauges higher than the duct piece having these fittings. Dampers shall be installed in duct at all required locations. **No extra payment shall be made separately since these form part of Air Circulation System.**

NOTE: In case angle iron supports are not feasible to be installed for supporting the ducts due to height constraint then the contractor shall support the ducts with M.S flats of at least double the thickness of the angle iron supports.

8.20 FIRE & SMOKE DAMPERS

a. All supply and return air ducts at AHU room crossings and at all floor crossings shall be provided with Motor operated Fire & smoke damper of at least 90 minutes rating as per UL555/1995 tested by CBRI. These shall be of multi-leaf type and provided with Spring Return electrical actuator having its own thermal trip for ambient air temperature outside the duct and air temperature inside the duct. Actuator shall have Form fit type of mounting, metal enclosure and guaranteed long life span.

b. Fire damper blades and outer frames shall be of 16G galvanized steel construction fitted with 16 gage extended sleeves on both sides. The damper blade shall be pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16G galvanized sheet steel. For preventing smoke leakage metallic compression seals will be provided.

c. The electric actuator shall be energized either upon receiving a signal from smoke detector installed in AHU room supply air duct / return air duct or temperature sensor. The fire damper shall also close upon sensing temperature rise in supply air ducts thru the electronic temperature sensor.

d. Each damper shall be provided with its own control panel, mounted on the wall and suitable for 240 VAC supply. This control panel shall be suitable for spring return actuator and shall have at least the following features:

- Potential free contacts for AHU fan ON/ Off and remote alarm indication.
- Accept signal from external smoke/fire detection system for tripping the electrical actuator.
- Test and reset facility.
- Indicating lights / contacts to indicate the following status:
- Power Supply On
- Alarm
- Damper open and close position.

e. Actuators shall be mounted on the sleeve by the damper supplier in his shop and shall furnish test certificate for satisfactory operation of each Motor Operated Damper in conjunction with it's control panel. Control panel shall be wall mounted type.

f. It shall be HVAC Contractor's responsibility to co-ordinate with the Fire Alarm System Contractor for correctly hooking up the Motor Operated Damper to Fire Detection / Fire Management System. All necessary materials for hooking up shall be supplied and installed by HVAC Contractor under close co-ordination with the fire protection system contractor.

g. HVAC Contractor shall demonstrate the testing of all Dampers and its control panel after necessary hook up with the fire protection / fire management system is carried out by energizing all the smoke detectors with the help of smoke.

h. HVAC Contractor shall provide Fire retardant cables wherever required for satisfactory operation and control of the Damper.

j. HVAC Contractor shall strictly follow the instructions of the Damper Supplier or avail his services at site before carrying out testing at site.

k. Fire/smoke damper shall be provided with factory fitted sleeves; however, access doors shall be provided in the ducts within AHU room in accordance with the manufacturer's recommendations.

l. The Contractor shall also furnish to the Owner, the necessary additional spare actuators and temperature sensor (a minimum of 5% of the total number installed) at the time of commissioning of the installation.

8.30 FIRE DAMPERS

a. Whenever a supply/return duct crosses from one fire zone to another, it shall be provided with approved fire damper of at least 1½ hour fire rating as per UL555/1995 tested by CBRI. This shall be curtain type fire damper.

b. Fire damper blades shall be one piece folded high strength 16 gage galvanized steel construction. In normal position, these blades shall be gathered and stacked at the frame head providing maximum air passage and preventing passing air currents from creating noise or chatter. The blades shall be held in position through fusible link of temp 70o C.

c. In case of fire, the intrinsic energy of the folded blades shall be utilized to close the opening. The thrust of the suddenly released tension shall instantly drive the blades down and keep it down without the use of springs, weights or other devices subject to failure.

d. Fire damper sleeves and access doors shall be provided within the duct in accordance with the manufacturer's recommendation.

e. The contractor shall also furnish to the Owner, the necessary additional fusible links (spares), as recommended by the manufacturer, at the time of commissioning of the installation.

8.40 A) THE **SUPPLY AND RETURN AIR GRILLS:**

The supply and return air grills shall be made of powder coated extruded aluminum sections. The supply air grills shall be provided with screw operated opposed blade volume control device made of extruded aluminum in black anodized finish.

All grills shall have soft continuous rubber / foam gasket between the periphery of the grills and surfaces on which it has to be mounted. The colour of grills shall be as per the approval of the Engineer in Charge.

B) LINEAR SUPPLY AND RETURN GRILLS

The linear continuous supply / return air grills shall be made of powder coated extruded aluminum construction with fixed horizontal bars. The thickness of fixed bar louvers shall be 5mm in front and the flange shall be 20mm wide with round edges. The register shall be suitable for concealed fixing and horizontal bars of the grills shall mechanically crimp from the back to hold them.

The colour of grills shall be as per the approval of the Engineer in Charge. The volume control device made of extruded aluminum construction in black anodized finish shall be provided in supply air duct collars only.

C) FRONT FIXED BAR REAR ADJUSTABLE LOUVERED GRILLS.

The grills shall be made of powder coated extruded aluminum construction with front fixed horizontal bar at 0 degree inclination with one way or two way deflection with rear vertical individually adjustable louvers in black shade mounted on Nylon bushes to hold deflection setting under all conditions of velocity and pressure.

The colour of grills shall be as per the approval of the Engineer in Charge. The volume control device of extruded aluminum construction in black anodized finish shall be provided in supply air duct collars.

D) SQUARE / RECTANGULAR CEILING DIFFUSERS.

The square / rectangular ceiling diffusers shall be made of powder coated extruded aluminum construction with flush fixed pattern. The diffusers shall have Anti-Smudge ring and spring loaded removable central core in various pattern for air flow direction. The diffusers shall be mounted by concealed screw fixing arrangement. The volume control device of extruded aluminum construction in black anodized finish shall be provided in supply air diffusers. The colour of diffuser shall be as per the approval of the Engineer in Charge.

E) VOLUME CONTROL DEVICE

The opposed blade volume control device shall be made of Powder Coated extruded aluminum construction in black anodized finish. Opposed blades shall be pivoted to extruded aluminum frame with Nylon bushes. Specially designed blade shall have an overlapping lip which shall ensure a tight closure.

F) FRESH AIR INTAKE LOUVERS WITH BIRD SCREEN

The fresh air intake louvers at least 50mm deep will be made of powder coated extruded aluminum construction. Bird / insect screen will be provided with the intake louvers. The blades shall be inclined at

45 degree on a 40mm blade pitch to minimize water ingress. The lowest blade of the assembly shall be extended out slightly to facilitate disposal of rain water without falling on door / wall on which it is mounted.

The intake louvers shall be provided with factory fitted aluminum construction volume control dampers in black anodized finish.

8.50 PAINTING

All ducts collar / shoot behind the grills / diffuser shall be given at least two coats oil black enamel paints.

8.60 TESTING

The complete duct system shall be tested for air leakage & complete air distribution system shall be balanced in accordance with air quantities indicated on the approved drawing.

STANDARD SPECIFICATION OF MOTOR CONTROL CENTRE (MV PANEL), AHU SUB-PANEL, POWER & CONTROL CABLING

9.00 This section deals with supply, installation, testing & commissioning of Motor Control Centre (MV panel), AHU Sub-Panels etc. & shall be manufactured by CPRI approved venders. The power / control cabling & earthing work shall be carried out as per the specification given below:

9.10 SCOPE

All work shall confirm to Indian Electricity Act (amended up to date), I.S. code of practices local rules and regulations etc. Power cabling shall be carried out with approved make of cables as indicated in the **List of approved make of equipment / materials** and shall be of grade 1100 volts, PVC insulated & sheathed, armored aluminum conductors cables. Control cabling shall be of approved make and shall be of grade 1100 volts, PVC insulated & sheathed, copper conductor armored multi core cables as specified in B.O.Q.

9.20 MOTOR CONTROL CENTRE (MV PANEL) / AHU SUB-PANEL

Motor control centre (MV Panel) floor mounted extendable type & wall mounted AHU sub-panel shall be fabricated out of 14G C.R.C.A. Sheet. These panels shall be cubical sectionalized type, totally enclosed dust & vermin proof. Gaskets shall be provided in all joints to prevent dust to reach the internals of the panels to make it completely dust proof. The degree of protections for panels shall be IP 52 for indoor applications and IP 55 for outdoor applications as per IS:2147.

This panel (MV) shall be suitable for voltages up to 500 volts, three phase 50 Hz, 4 wire supply capable of functioning satisfactorily in temperature ranging up to 45 to 50 degree centigrade and rupturing capacity suitable for connected load & design should be type tested for 42 KA fault level. All joints of panels shall be welded and braced as necessary to provide a rigid support for all components. The base channel provided in the floor mounted MV panel shall be 75mm high & clear spaces of 200mm between the floor and the bottom most part of the unit shall be provided. The panel shall be correctly positioned. Self-threading screws shall not be used in the construction of control panels. Appropriate knock-out holes of proper sizes shall be provided for incoming and outgoing cables. The facility for bottom or top entry of cables in the panels shall be provided. Necessary cables clamps shall provided for holding the cables in position.

All power/control wiring inside the panel shall be colour coded and control wiring ferruled for identification purpose. All labeling shall be provided in engraved anodized aluminum strips on the front faces of the panel.

Each circuit breaker shall be housed in separate compartments. It shall have steel sheets on top and bottom of compartment. The steel sheet hinged door shall be interlocked with the circuit breaker on the “ON” position. When the breaker is on the “ON” position, suitable preventive measures shall be provided, such as interlocks, to prevent the breaker from being drawn out. When the breaker is in “ON” position steel sheet shall be provided between the tiers in the vertical section. The door of this compartment shall not form part of the draw out arrangements.

9.30 BUS-BARS

The bus-bar and its connections shall be aluminum Electrolytic grade E-91 as per IS: 5082 and shall be of rectangular section. The amperage capacity of Aluminium bus bar shall 1A / Sq. mm. These should be suitable for full load current for phase bus-bar and neutral bus-bar shall be of half rated current capacity. The bus-bar should have provision on either side for extension. The bus-bar should be sleeved with colour coded heat shrinkable PVC sleeve. Bus-bar supports shall be of fiber glass reinforced thermosetting polyester having in built and tracking barriers to break the path of conducting dust through moulded ribs.

In panels bus-bar connections shall be done by drilling holes with cadmium coated bolts and nuts. Extra cross section shall be provided to compensate drilling of the holes. Insulated aluminum strips of suitable size of full rated current capacity shall be used for interconnecting bus-bar and breaker.

A horizontal / vertical wire way shall be provided for interconnecting control wiring between different vertical sections.

The terminal blocks shall be used for outgoing terminals and neutral link at a suitable located places in the control panel. Separate compartments for outgoing and incoming cable shall be provided. The current transformers of all instruments shall be mounted with terminal blocks.

All live parts including incoming and outgoing link / terminals should be totally shrouded by means of non hygroscopic and fire retardant material.

9.40 ROTARY SWITCH / SELECTOR SWITCH / SWITCHES / HRC FUSES / STARTERS / SINGLE PHASE PREVENTERS / TOGGLE SWITCH.

These shall be of approved make and conforming to relevant TRIPURA RAJ BHAVAN standard. The rupturing capacity of HRC fuses should not less than 80 KA and in case of switches it should be 60 Amps maximum.

9.50 CURRENT TRANSFORMER

The current transformers shall have accuracy of class I and 5P10 / 10P10 and suitable VA burden for operation of the connected meters and relays.

9.51 OVERLOAD RELAYS

All the motors shall have overload relay protections conforming to relevant IS.

9.52 TIME DELAY RELAYS

These shall be adjustable type with time delay adjustments of 0-180 or as per manufacturers standards.

9.53 INDICATING LAMPS AND METERING

These shall confirm to BS37 & BS39. All meters shall be flush mounted and draw-out type. The indicating lamp shall be filament type and with very low burden & economy resistor.

9.54 VOLTMETER AND AMMETERS

Motor Control Centre (MV Panel) shall have flush type voltmeter & ammeter of size 96 x 96 mm as detailed in B.O.Q.

9.55 PUSH BUTTON STATIONS

These shall be suitable for panel mounting and accessible from front without opening. These shall be provided for manual starting and stopping of motors/equipments as per normal practices. The contacts shall be suitable for 6AMP current capacity.

9.56 CONDUITS

These shall be preferable made of mild steel, stove enameled from inside and outside with minimum wall thickness of 1.6 mm for conduits up to dia of 25mm and 2 mm for conduits above 25 mm diameter.

9.57 CABLES

These shall be PVC insulated, pre-sheathed, aluminum conductor armored cables as per IS:694 and as per **list of approved make of equipment / materials.** Control Cables shall be multi-core PVC-insulated PVC sheathed copper conductor and armored cables of approved make only.

9.58 LAYING OF CABLES

These shall be laid as Indian Standard code of practice. All cables shall be laid on **16G Cadmium Plated U shaped Channel** 40mm x 20mm cable trays. In case more than one cable is running, then proper spaces in between the two cables shall be provided to avoid loss of current carrying capacity. While cables are running on walls, proper saddles must be provided.

9.59 WIRE SIZES

Single stand PVC-copper conductor wires shall be used inside the control panel for interconnecting different components. All wires shall be neatly dressed and coloured beads shall be provided for easy identification in control wiring. The minimum size of control wiring shall be 1.5sq.mm Cu. Testing of panels as per code of practice shall be done at works by AC contractor before inspection & dispatch to site.

9.60 DRAWINGS

Necessary drawings of all control panels and wiring of equipment etc., shall be submitted by the A.C contractor for approval of the Engineer in Charge. On final completion of job and before handing over of AC System As Built Drawings shall be submitted to the Department.

9.61 TESTING

The complete electrical installation shall be tested in accordance with relevant ISI codes in presence of Electrical Supervisor of the Department before commissioning of plant.

9.62 PAINTING OF PANELS

All sheet metal enclosures shall be powder coated only after de-rusting & hot-dip phosphating degreasing etc. at works only.

NOTE: Rubber mats of 1100 volts shall be laid in front of all switch boards as specified in BOQ.

9.70 SIZES OF POWER CABLING

The following size of power cabling shall be used only:

	HP of Motors	**Cable size**
a)	Up to 5 HP	3c x 4 sq.mm aluminium conductor armored cable.
b)	5 to 7.5 HP	3c x 6sq.mm aluminium conductor armored cable.
c)	10 to 15 HP	2no. 3c x 6sq.mm aluminum conductor armored cable.
d)	20 to 25 HP	2 nos.3 x16sq.mm aluminum conductor armored cable.
e)	30 to 35 HP	2 nos.3cx25sq.mm aluminum conductor armored cable.

9.71 CAPACITY OF RELAYS AND CONTACTS

The following capacity relays and contacts shall be used for various rating of motors:

Type of Starter	Contactor	Overload Relay	Current	Phase Relay Range
a) 30 HP Motor	Star Delta Starter		40 Amp.	20-33 Amp.
b) 25 HP Motor	Star Delta Starter		32 Amp.	14-23 Amp.
c) 20 HP Motor	Star Delta Starter		32 Amp.	14-23 Amp.
d) 15 HP Motor	Star Delta Starter		25 Amp.	9-15 Amp.
e) 10 HP Motor	Star Delta Starter		16 Amp.	6-10 Amp.
f) 7.5 HP Motor	D.O.L. Starter		16 Amp.	9-15 Amp.
g) 5 HP Motor	D.O.L. Starter		16 Amp.	6-10 Amp.

9.72 EARTHING

The earthing of all equipments shall be carried out by Copper strips / wires as mentioned in **Bill of Quantities.** All panels / three phase motors shall be earthed with two number distinct and independent Copper strips / wires of the following sizes:

1. Motor up to 5.5 KW 3 sq. mm Copper Wire
2. Motor 7.5 to 12 KW 4 sq. mm Copper Wire
3. Motor 12 to 50 KW 25x3 mm Copper Strip

The earthing connections shall be connected to main earth station or main earth grid. The earth connections shall be connected to equipments after removal of paint, grease etc.

10.0 NOISE AND VIBRATION CONTROLS

10.00 The air conditioning contractor must take all necessary precautions to have minimum noise generation and its transmission. Minimum vibration as permitted by IS relevant code shall be ensured. A few points for guidance only are given below:

10.01 a) Double fire retardant flexible connections shall be provided from air discharge to outlet of air-handler to the duct.

b) Vibration isolation pads of suitable thickness commensurate to loading for isolation of vibration shall be provided under all Exhaust Fans, air handlers fans etc. in consultation with manufacturer for proper selection of vibration isolators

c) Flexible conduit connections of minimum diameter of 50mm to motors shall be provided. All loops should be large enough to allow connections to remain flexible.

d) All conduit connection where conduits are 60mm or larger shall be made of 1.2 meters minimum length conduit installed in the shape of U and grossly slack to provide maximum vibration isolation.

e) All items suspended from false ceiling shall be isolated on separate hangers.

f) In case of ducts, conduits, pipes & tubes the annular space between construction and penetrating element shall be sealed with sand cement plaster.

g) The supply duct starting from air handling unit & plenum shall be provided with 25 mm thick acoustic lining as indicated in the tender drawings. All Fan Coil Units collar shall also be lined with 12mm thick acoustically lined. The duct lining shall be done with fibre glass of density of 32 kg/cubic meter.

h) The air-conditioning contractor shall take all other precautions or shall make his own arrangements even if not specified in the tender documents for eliminating high noise levels & shall minimize vibrations in all mechanical equipments without any additional cost.

MODE OF MEASUREMENT

The following measurement code shall apply to the Contract:

2.00 SHEET METAL WORK

1. DUCTING

a) The final finished sheet area in sq. mt shall be measured only.

b) Vanes, splitters, flanges, access doors etc. shall not be separately measured. These shall be treated as part of duct work.

c) Bends, Elbows, Transformation, pieces etc. shall be measured along the centre line and measured as per duct work.

d) Canvas connections, Duct Supports, Stiffening members, frames etc. shall not be measured separately and shall form part of duct work.

2. GRILLS / DIFFUSERS / FIRE DAMPERS

All Grills / Diffusers / Fire Damper areas will be measured in terms of effective area (Neck Area). Any Extruded aluminum grill / diffusers having an area less than 0.1 sq.mt shall be accounted as 0.1 sq.mt.

3. BOX DAMPERS

a) No separate measurement of box dampers shall be done since they form part of duct.

b) Fresh air dampers shall be measured as effective areas only. No separate measurements for bird screen inlet / outlet louvers shall be done.

2.10 PIPING WORK

a) The length of piping accessories & fittings shall be measured along its centre line in meters and no measurements for bends, elbows, tees etc. shall be made. All such fittings / accessories shall be treated as part of the piping work.

b) Flanges shall not be measured, as they form part of piping work.

c) All kinds of supports, hangers etc shall be part of piping work & no extra measurements shall be done.

d) No additional price for installation of purge & descaling valves as required at site shall be paid.

2.20 INSULATION

2.21 A) Insulation Of Duct

1. This shall be measured on the basis of bare duct surface area i.e. the area of duct insulation & area of duct shall be same.

B**) Acoustic Lining Of Duct & Plenum**

This shall be measured on the basis of bare duct surface area i.e. the area of duct lining & area of duct shall be same.

2.30 ELECTRICAL CABLING WORK

a) All power cables / controls cables shall be measured on linear basis in meters.

b) No extra price shall be paid on account of end termination of cables which includes thimble, gland etc.

2.40 STRUCTURAL SUPPORTS

No extra price shall be paid on account of structural supports required for piping, ducting & cabling work.

PAINTING WORK

This section deals with painting of various equipment / material supplied under this contract. It gives basic guidance for painting as specified below:-

a) **Application**: The original colour of all equipments like VRF Condensing Units, air-handling units etc. which if get damaged during transportation or during installation shall be painted in original shade with the two coat of paint to give a final finish.

COLOUR SCHEME FOR THE EQUIPMENTS / MATERIALS

i)	Electrical panels/sub-panel/ remote control console	---	Light grey powder coated
ii)	Cable trays	---	Zinc Cromate & Aluminium Paint
iii)	Supports for ducts	---	Silver

ASSOCIATED CIVIL / ELECTRICAL AND OTHER WORKS TO BE PROVIDED FREE OF COST TO THE AC CONTRACTOR BY THE CLIENT (THROUGH THEIR OWN AGENCIES)

(To Be Arranged By Client Through Their Own Agencies At Their Own Cost.)

a) Stabilised three phase four wire AC supply i.e. 415 Volts ± 10 % & 50 Hz ± 5 % with double earthing shall be made available in the plant room & in air handling unit room by the client through their own agency.

b) Any kind of exposed roof insulation work.

c) Drain points in AHU.

d) Any kind of masonry shafts for laying pipes / cables / ducts etc.

Fire signal from potential free contact from fire panel to be wired to each AHU room.

LIST OF APPROVED MAKES OF EQUIPMENTS / MATERIALS

1.	Air Cooled Scroll Chiller	- Voltas / Blue Box / Blue Star/ CARRIER / Cimeventa
2.	Air-handling Units	- BLUE STAR / Zeco / Edgetech
3.	GSS Sheet	- Sail / Tata
4.	Fire & Smoke Damper Spring Type	- Dynacraft / Ravi-Star
5.	Fire Damper Actuator	- Belimo / Siemens
6.	Extruded aluminum grills / Diffusers	- Dynacraft / Ravistar
7.	Pre Filters	- Thermodyne / Klenzoid / Purolator
8.	Glass wool blankets	- U.P.Twiga / Owen Corning
9.	Nitrile rubber Insulation	- Armacell / A Flex
10.	Paints	- ICI / Asian
11.	Three phase motors	- C. G / Siemens / Kirloskar / ABB / Bharat Bijlee.
12.	Make of Electrical Panel, Control Console Panel & AHU Sub-panels	- EAP / Legrand / JD enterprise
13.	M.C.C.B.	- L&T / GE (Imported) / Siemens (Germany) / Schinder (Imported) / ABB (Imported)
14.	MCB	- L&T / GE (Imported) / Siemens (Germany) / Schinder (Imported) / ABB (Imported)
15.	Starters, Contactors, Push Buttons, Overload Relay	- L&T / GE (Imported) / Siemens (Germany) / Schinder (Imported) / ABB (Imported)
16.	Single Phase Preventer	- L&T / Minilec / Siemens
17	MS pipe	- Tata / Jindal/Bansal
18.	Butterfly Valve	- Advance / C&R / Intervalve / KITZ / Balimo
19.	Check Valve	- H Sarkar / C&R / Advance
20.	Motorized Butterfly valve	- Siemens / Balimo
21.	2 way motorized Proportionate valve	- Siemens / Honeywall / Balimo.
22.	3 speed switch with thermostat	- Honeywell / Siemens.
23.	Flow switch	- Honeywell / Siemens

24.	Y Strainer	- H Sarkar / Sant
25.	Flexible Rubber Bellow	- Cori / Resistoflex.
26.	Ball valve / Gate Valve	- Audco / Leader.
27.	Pump	- Grundfoss / Kirloskar **/** Wilo / ITT

NOTE: ALL MAKES SHALL CONFIRM TO STANDARD SPECIFICATIONS OF EACH ITEMS AS ENCLOSED WTH THE TENDER DOCUMENTS

Bill of Quantity of Air Conditioning System for ICWA					
Sl no.	**Description of item**	**Unit**	**Qty.**	**Rate**	**Amount**
(a)	**CENTRAL CHILLER PLANT SYSTEM**				
1.1	**Air Cooled Scroll Chiller**				
	Supply, installation, testing & Commissioning of Air **cooled** chiller with Multiple **Scroll Compressor and refrigerant circuit** of Capacity 40**TR actual capacity** at 40 deg.C ambient temperature. Chilled water inlet temperature 12 deg C & Outlet temperature 7 deg C. The Fouling factor of Chiller should be 0.0005 FPS unit. The Chiller should consist of Control panel with Microprocessor Controller (Controller should have all safety interlocks like high / low pressure cut outs, oil pressure cut outs, high current and low voltage trip, phase reversal protection along with display for % of loading &, Current for each compressor, Suction & Discharge pressure, ambient Temperature, Chiller Inlet & Out let temperature, Pressure drop across Chiller), , refrigeration accessories, first charge of refrigerant and oil, mounting arrangement etc. complete in all respect to commission. Refrigerant shall be R 407C / R-22.	Nos.	1		
	Make : Voltas / Bluestar / Climeventa / Blue Box/ Carrier				
	Installation, Testing & Commissioning Charge	Nos.	1		
	80 mm Butterfly valve	Nos.	2		
	80 mm dia Balancing valve	Nos.	1		
	Flexible Rubber Bellow - 80 mm dia	Nos.	2		
	Dial type (4" dial) pressure gauge (0-150 psi) with necessary fittings and isolation valve	Nos.	2		
	Stem Type Thermometer for measuring temperature in Chilled water and cooling water.	Nos.	2		
	Flow Switch	Nos.	1		
	25/20 mm dia Gate/ball Valve for De-scaling	Nos.	2		
2.0	**PUMPS**				
2.1	**Chilled Water Pumps**				
	Supply, Installation, Testing and Commissioning of Chilled water primary pump sets having head of 25 mwc at a discharge rate of 96 us gpm. (1w+1s) including motor, base frame and coupling etc. to complete the installation.	Nos.	2		
	Make : Groundfoss / Kirloskar / Wilo / ITT				
	80mm dia Butterfly valve	Nos.	4		
	80mm dia Check valve(NRV)	Nos.	2		
	80mm dia Y-Strainer	Nos.	2		

	Dial type (4" dial) pressure gauge (0-150 psi) with necessary fittings and isolation valve	Nos.	2		
	Flexible Rubber Bellow 80 mm dia	Nos.	4		
	Spring type Isolation for Pump	Set	2		
3.0	**Supply, installation, Testing & Commissioning of Floor Mounted Horizontal Double skin air handling unit with blower, Drive package, motor, cooling coil, filters, Mixing chamber, thermal break profile and Return air, Supply air & Fresh damper and other accessories as required to complete the installation.**				
	Make : Zeco / Edgetech/ Bluestar				
	40.0TR, 7500 CFM, 40mm static 6 row deep Cooling Coil for Auditorium at Ground Floor.	Nos.	1		
	80 mm NB Butterfly Valve	Nos.	2		
	65 mm NB 3-way Mixing valve with Actuator & Proportionate type thermostat and Cabling	Nos.	1		
	80 mm dia Y-Strainer with SS screen	Nos.	1		
	4" Dial type Pressure gauge	Nos.	2		
	100 mm Long Temperature Indicatior	Nos.	2		
	Test Point	Nos.	2		
	AHU panels for AHU blower (Star delta/DOL), with overload & single -phase protection, Control Fuse, Indication Lamp, Ammeter, Voltmeter, 24V supply transformer, Incoming MCB. The AHU panel should have with ON/OFF/Trip indication and also with ON/OFF push button etc.	Nos.	1		
	Make :EAP/ JD enterprise / Legrand				
4.0	**Piping Works**				
4.1	M.S ERW class "B" pipes for chilled water circulation including all necessary fittings and accessories. Make : Tata / Jindal / Bansal				
	80mm NB	Mtr.	30		
4.2	Chilled water pipe insulated with 19 mm Auiminium Foil face Nitrial Rubber, Class – O of Armacell / A Flex make pipe section along with necessary adhesive				
	80mm NB with	Mtr.	30		

5.0	Drain / Condensate drain water piping with G.I. Class "B" pipes as per IS - 1239. Condensates drain water insulation with 13 mm thk. aluminium Foil Faced Closed Cell Nitrial rubber pipe section of Armacell / A-Flex..				
	40 NB	Rmt.	20		
7.0	Auto Air Vent				
	10 mm dia with isolation valve	Nos.	2		
8.0	**Air Distribution Works**				
8.1	GSS ducting with turning vanes, GI down rods and support angles.				
	22 SWG	Sqmt.	95		
	24 SWG	Sqmt.	92		
9.0	Acoustic lining of ducts complete with Arma Sound 120 of 10 mm along with adhesive. etc. of Armacell make.	Sqmt.	190		
10.1	MS/GI Duct Damper	Sq mt.	0.62		
10.2	Fusible link type Fire Damper with limit switch	Sq mt.	0.51		
10.3	Fusible like as per UL 555	Nos	2		
10.3	Fresh air Damper	Sq mt.	0.2		
10.4	Collar Damper	Sq mt.	1.5		
11.0	Supply and installation Extruded Aluminum S.A. linear Grill with all side flange.	Sqm	4.6		
13.0	Under deck Insulation with 50mm TF quality Expanded Polystyrene of 20 kg/m3 density covered with Chicken wire mesh.	Sqm.	270		
14.0	**Electrical Works**				

14.1	Main MCC complete with 1no. Incomer suitable for cable Connection, and outgoing feeders for 1 Nos chilling Unit, 2 nos (1w + 1s) Chilled water pumps Star Delta Starter, One No. Outgoing feeder for AHU with MCCB. MCC shall be floor mounted fixed construction type with AL bus bar of 35 KA fault level and incoming with MCCB of suitable capacity . All the starter, switched etc should have matched characteristic and having ICO & ICU equal and all the overload etc should be matched as per type 2 Co-ordination. All the incoming MCCB should have short circuit trip, under voltage, over Voltage, Over current & earth fault trip arrangement. Ammeter shall be considered for all outgoing feeders with Suppress scale and voltmeter for the incomer. Necessary potential free contact tips to be kept to monitor the ON/OFF/TRIP status and also to operate all the drives from BMS.	Nos.	1		
	Make :EAP/ JD enterprise / Legrand				
15.0	Cables:1100 V grade PVC insulated armored cables as per IS - 1554.(Including termination)				
a	3.5C X 95 mm sq. Al XLPE CABLE (For main Incoming Cable))	RMT	50		
b	3.5C X 70 mm sq. Al (For Chiller))	RMT	40		
b	3C X 25 mm sq. Al (Secondary Pumps)	RMT	30		
d	3C X 6 mm sq. Al for AHU	RMT	50		
16.0	Cable trays in A.C. Plant area				
a	300 mm wide	RMT	RO		
b	200 mm wide	RMT	50		
c	150 mm wide	RMT	25		
17.0	Earthing and Termination between equipment and electrical panels supplied by the AC contractor.	Lot	1		
	SUB TOTAL OF PART				

Bill of Quantity of Air Conditioning System for ICAI					
Sl no.	**Description of item**	**Unit**	**Qty.**	**Rate**	**Amount**
(a)	**CENTRAL CHILLER PLANT SYSTEM**				
1.1	**Air Cooled Scroll Chiller**				
	Supply, installation, testing & Commissioning of Air **cooled** chiller with Multiple **Scroll Compressor and refrigerant circuit** of Capacity 40**TR actual capacity** at 40 deg.C ambient temperature. Chilled water inlet temperature 12 deg C & Outlet temperature 7 deg C. The Fouling factor of Chiller should be 0.0005 FPS unit. The Chiller should consist of Control panel with Microprocessor Controller (Controller should have all safety interlocks like high / low pressure cut outs, oil pressure cut outs, high current and low voltage trip, phase reversal protection along with display for % of loading &, Current for each compressor, Suction & Discharge pressure, ambient Temperature, Chiller Inlet & Out let temperature, Pressure drop across Chiller), , refrigeration accessories, first charge of refrigerant and oil, mounting arrangement etc. complete in all respect to commission. Refrigerant shall be R 407C / R-22.	Nos.	1	880000	880000
	Make : Voltas / Bluestar / Climeventa / Blue Box/ Carrier				
	Installation, Testing & Commissioning Charge	Nos.	1	100000	100000
	80 mm Butterfly valve	Nos.	2	1800	3600
	80 mm dia Balancing valve	Nos.	1	6500	6500
	Flexible Rubber Bellow - 80 mm dia	Nos.	2	3500	7000
	Dial type (4" dial) pressure gauge (0-150 psi) with necessary fittings and isolation valve	Nos.	2	2000	4000
	Stem Type Thermometer for measuring temperature in Chilled water and cooling water.	Nos.	2	900	1800
	Flow Switch	Nos.	1	2500	2500
	25/20 mm dia Gate/ball Valve for De-scaling	Nos.	2	900	1800
2.0	**PUMPS**				
2.1	**Chilled Water Pumps**				
	Supply, Installation, Testing and Commissioning of Chilled water primary pump sets having head of 25 mwc at a discharge rate of 96 us gpm. (1w+1s) including motor, base frame and coupling etc. to complete the installation.	Nos.	2	120000	240000
	Make : Groundfoss / Kirloskar / Wilo / ITT				
	80mm dia Butterfly valve	Nos.	4	1800	7200
	80mm dia Check valve(NRV)	Nos.	2	1400	2800

	80mm dia Y-Strainer	Nos.	2	3900	7800
	Dial type (4" dial) pressure gauge (0-150 psi) with necessary fittings and isolation valve	Nos.	2	2000	4000
	Flexible Rubber Bellow 80 mm dia	Nos.	4	900	3600
	Spring type Isolation for Pump	Set	2	2500	5000
3.0	**Supply, installation, Testing & Commissioning of Floor Mounted Horizontal Double skin air handling unit with blower, Drive package, motor, cooling coil, filters, Mixing chamber, thermal break profile and Return air, Supply air & Fresh damper and other accessories as required to complete the installation.**				
	Make : Zeco / Edgetech/ Bluestar				
	40.0TR, 7500 CFM, 40mm static 6 row deep Cooling Coil for Auditorium at Ground Floor.	Nos.	1	**250000**	250000
	80 mm NB Butterfly Valve	Nos.	2	1800	3600
	65 mm NB 3-way Mixing valve with Actuator & Proportionate type thermostat and Cabling	Nos.	1	12000	12000
	80 mm dia Y-Strainer with SS screen	Nos.	1	3900	3900
	4" Dial type Pressure gauge	Nos.	2	2000	4000
	100 mm Long Temperature Indicatior	Nos.	2	900	1800
	Test Point	Nos.	2	472	944
	AHU panels for AHU blower (Star delta/DOL), with overload & single -phase protection, Control Fuse, Indication Lamp, Ammeter, Voltmeter, 24V supply transformer, Incoming MCB. The AHU panel should have with ON/OFF/Trip indication and also with ON/OFF push button				35000
	etc.	Nos.	1	35000	0
	Make :EAP/ JD enterprise / Legrand				
4.0	**Piping Works**				
4.1	M.S ERW class "B" pipes for chilled water circulation including all necessary fittings and accessories. Make : Tata / Jindal / Bansal				
	80mm NB	Mtr.	30	684	20520
4.2	Chilled water pipe insulated with 19 mm Auiminium Foil face Nitrial Rubber, Class – O of Armacell / A Flex make pipe section along with necessary adhesive				
	80mm NB with	Mtr.	30	600	18000
5.0	Drain / Condensate drain water piping with G.I. Class "B" pipes as per IS - 1239. Condensates drain water insulation with 13 mm thk. aluminium Foil Faced Closed Cell Nitrial rubber pipe section of Armacell / A-Flex..				

	40 NB	Rmt.	20	400	8000
7.0	Auto Air Vent				
	10 mm dia with isolation valve	Nos.	2	1115	2230
8.0	**Air Distribution Works**				
8.1	GSS ducting with turning vanes, GI down rods and support angles.				
	22 SWG	Sqmt.	95	745	70775
	24 SWG	Sqmt.	92	635	58420
9.0	Acoustic lining of ducts complete with Arma Sound 120 of 10 mm along with adhesive. etc. of Armacell make.	Sqmt.	190	1200	228000
10.1	MS/GI Duct Damper	Sq mt.	0.62	6500	4030
10.2	Fusible link type Fire Damper with limit switch	Sq mt.	0.51	6500	3315
10.3	Fusible like as per UL 555	Nos	2	750	1500
10.3	Fresh air Damper	Sq mt.	0.2	3500	700
10.4	Coller Damper	Sq mt.	1.5	4500	6750
11.0	Supply and installation Extruded Aluminium S.A. linear Grill with all side flange.	Sqm	4.6	8500	39100
12.0	Under deck Insulation with 50mm TF quality Expanded Polystyrene of 20 kg/m3 density covered with Chicken wire mesh.	Sqm.	270	600	162000
13.0	**Electrical Works**				

13.1	Main MCC complete with 1no. Incomer suitable for cable Connection, and outgoing feeders for 1 Nos chilling Unit, 2 nos (1w + 1s) Chilled water pumps Star Delta Starter, One No. Outgoing feeder for AHU with MCCB. MCC shall be floor mounted fixed construction type with AL bus bar of 35 KA fault level and incoming with MCCB of suitable capacity . All the starter, switched etc should have matched characteristic and having ICO & ICU equal and all the overload etc should be matched as per type 2 Co-ordination. All the incoming MCCB should have short circuit trip, under voltage, over Voltage, Over current & earth fault trip arrangement. Ammeter shall be considered for all outgoing feeders with Suppress scale and voltmeter for the incomer. Necessary potential free contact tips to be kept to monitor the ON/OFF/TRIP status and also to operate all the drives from BMS.	Nos.	1	450000	450000
	Make :EAP/ JD enterprise / Legrand				
14.0	Cables:1100 V grade PVC insulated armored cables as per IS - 1554.(Including termination)				
a	3.5C X 95 mm sq. Al XLPE CABLE (For main Incoming Cable))	RMT	50	600	30000
b	3.5C X 70 mm sq. Al (For Chiller))	RMT	40	572	22880
b	3C X 25 mm sq. Al (Secondary Pumps)	RMT	30	496	14880
d	3C X 6 mm sq. Al for AHU	RMT	50	307	15350
15.0	Cable trays in A.C. Plant area				
a	300 mm wide	RMT	RO		
b	200 mm wide	RMT	50	650	32500
c	150 mm wide	RMT	25	590	14750
16.0	Earthing and Termination between equipment and electrical panels supplied by the AC contractor.	Lot	1	5000	5000
	SUB TOTAL OF PART				**2797544**

THE INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI)
12, Sudder Street, Kolkata– 700 016

General summary

Item No.	Description of work	Amount Rs. P.
1.	Air conditioning work	27,97,544.00

Rupees twenty seven lakh ninety seven thousand five hundred forty four only.

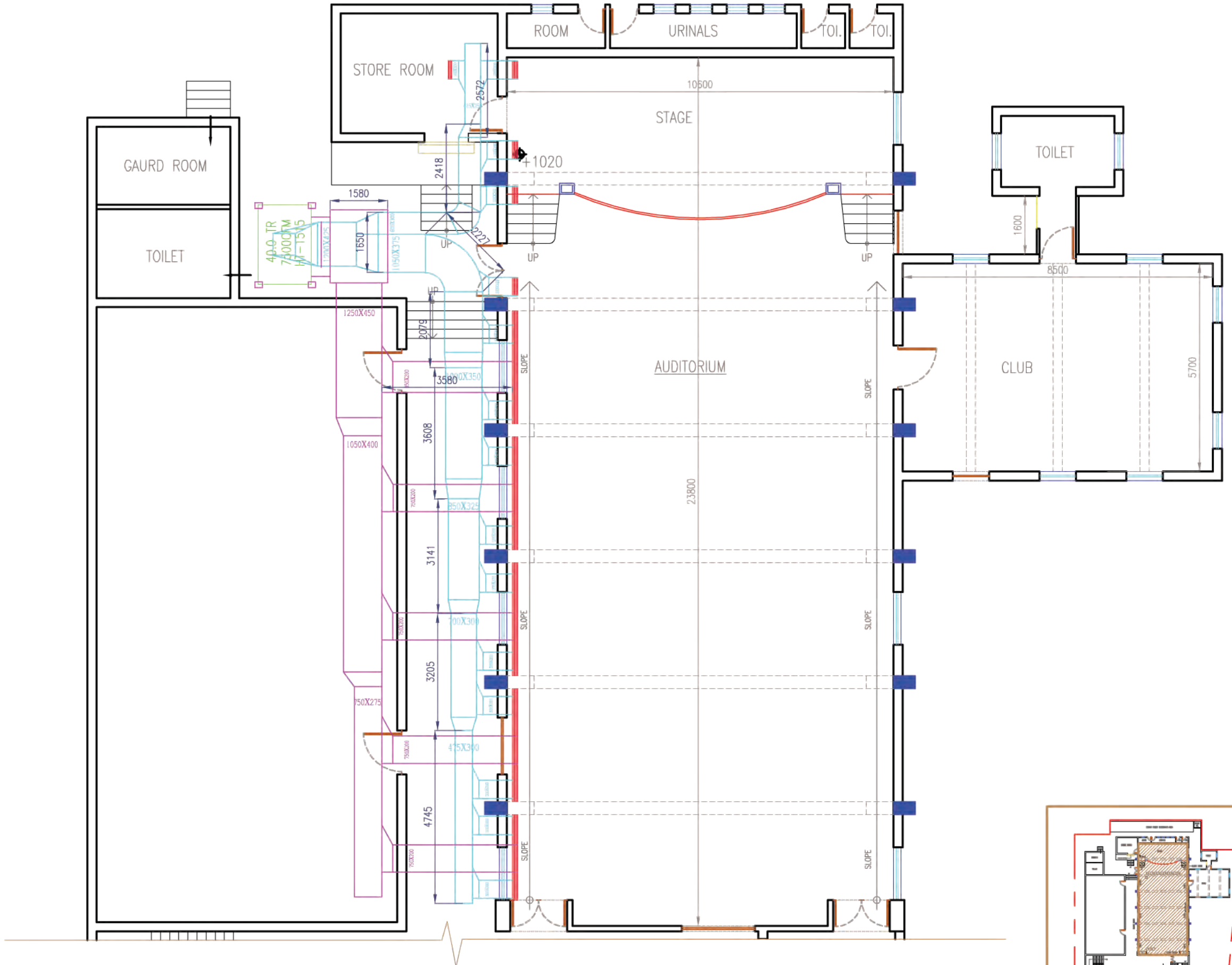
TENDER - PRICE BID

I / We agree to carry out the work mentioned in the tender at par* / _____% (_____percent) above* / _____% (_____ percent) below* the rates shown in the specified price schedule of probable items with approximate quantities.

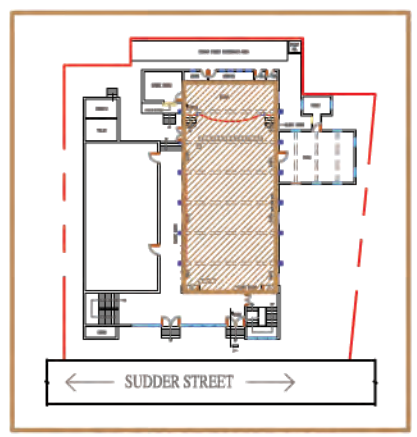
Signature of the Tenderer with Seal and Date

Signature of the Tender accepting Authority

* Please strike out whichever is not applicable



AIR CONDITIONING LAYOUT FOR AUDITORIUM IN GROUND FLOOR



KEY PLAN OF GROUND FLOOR

NOTES

1. ALL DIMENSIONS ARE IN MILIMETRES
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED

AREA :

AREA OF AUDITORIUM = 272.52 SQM.

LEGEND

NO	DESCRIPTION	SYMBOL
1.	SUPPLY DUCT	
2.	RETURN AIR DUCT	
3.	SUPPLY GRILL	

PROJECT:

AIR CONDITIONING WORK IN AUDITORIUM OF INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI)

CLIENT :

INSTITUTE OF COST ACCOUNTANTS OF INDIA (ICAI)

DRAWING TITLE :

HVAC LAYOUT OF AUDITORIUM IN GROUND FLOOR

HVAC CONSULTANT :

AIRTECH CONSULTANCY SERVICES
CG-145, SALT LAKE, SECTOR-II
KOLKATA - 700 091

ARCHITECT:

PARTHA DAS & ASSOCIATES
ARCHITECTURE,URBAN DESIGN,LANDSCAPE,INTERIORS
AE-377,SECTOR-I,SALTLAKE CITY,CALCUTTA-700064

ISSUED FOR TENDER PURPOSE ONLY

DATE - 20.03.2013	DESIGN -
SCALE - 1:100 @A3	CHK. BY - DD
DRAWN BY - KANAUJ	D. NO. - PDA/ICAI/AD/TND/AR 1