**INDIRA GANDHI INSTITUTE OF DEVELOPMENT RESEARCH.**

**GOREGAON (EAST), MUMBAI**

TENDER DOCUMENT FOR

**UPGRADATION OF INFRASTRUCTURAL FACILITIES**

SEMINAR ROOM- 1 AC DUCTING & AHU WORK

**Project Consultants**

**M/s DESIGN IDEAS**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

102, VASANT KUNJ, PLOT NO 163/E, OFF DR AMBEDKAR RD, DADAR (EAST), MUMBAI-400014.

TEL: 24118778. TELE/FAX: 24121713. MAIL: ideas.design@yahoo.com

Section (A)

# Letter of Offer

Place \_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_

Shri Jai Mohan Pandit

Registrar,

Indira Gandhi Institute of Development& Research,

Gen.A.K Vaidya Marg ,Filmcity Road

Goregaon (East ) , Mumbai 400065.

Dear Sir,

Having examined the Drawings, Specifications, Designs and Schedule of Quantities relating to the works specified in the Memorandum herein after set out and having visited and examined the site of the works specified in the said Memorandum and having acquired the requisite information relating thereto as affecting the tender, I/We hereby offer to execute the works specified in the said Memorandum within the time specified in the said Memorandum at the rates mentioned in the Schedule of Quantities and in accordance in all respects with the Specifications, Designs, Drawings and Instructions in writing referred to in Conditions of Tender, the Articles of Agreement, Special Conditions, Schedule of Quantities and Conditions of Contract and with such materials as are provided for, by and in all other respects in accordance with such conditions so far as they may be applicable.

M E M O R A N D U M

|  |  |  |
| --- | --- | --- |
| a) | Description of work | **SEMINAR ROOM 1 AC DUCTING & AHU WORK** |
| b) | Earnest Money Deposit | **Rs.25,000.00/-** |
| c) | Estimated cost | **Rs. 10,89,846.00/-**  |
| d) | Percentage if any to be deducted from Bills | **3%** |
| e) | Time allowed for completionof the work from the date ofwritten order to commence work : | **2 month** |

1. Should this tender be accepted, I/We hereby agree to abide by and fulfill the terms and provisions of the said Conditions of Contract annexed hereto so far as they may be applicable or in default thereof to forfeit the EMD and pay to the IGIDR the amount mentioned in the said Conditions.

I/We have deposited a sum of **Rs.** **25,000.00** as earnest money with the IGIDR, which amount will not bear any interest. Should I/We fail to execute the contract when called upon to do so. I/We do hereby agree that this sum shall be forfeited by me/us to the IGIDR.

Our Bankers are:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The names of partners of our firm are:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Address \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of the partner of the firm authorized to sign. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

OR

Name or person having power

of attorney to sign the contract. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Certified copy of power of

Attorney should be attached.)

 Yours faithfully,

 **(**Signature of the Contractor)

**Witness:**

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 Signature

Address ……………………………

 …………………………….

 ……………………………

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Signature

Address: …………………………….

 ……………………………

 ……………………………

**ARTICLES OF AGREEMENT**

ARTICLES OF AGREEMENT made the ……………………………. day of ………………………………………………………….. Between the Indira Gandhi Institute of Development Research (hereinafter called "the Employer") of the one part and ………………………………………

…………………….. (Hereinafter called "the Contractor") of the other part.

WHEREAS the employer is desirous of **Air Conditioning Ducting & AHU work for Seminar Room-1** Works at IGIDR. Goregaon (Mumbai and has caused Drawings and Bill of Quantities showing and describing the work to be done prepared by or under the directions of Institute`s architect/Engineers.

AND WHEREAS the said drawing numbered \_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ inclusive, the specifications and the schedule of Quantities have been signed by or on behalf of the parties hereto.

AND WHEREAS the Contractor has agreed to execute upon and subject to the conditions set forth herein and in the correspondence attached hereto and to the Conditions set forth in the Special Conditions and in the Schedule of Quantities and Conditions of Contract (all of which are collectively herein after referred to as "the said Conditions") the works described in the said Specifications and included in the said Schedule of Quantities at the respective rates therein set forth amounting to the sum as therein arrived or such other sum as shall become payable there under (hereinafter referred to as "the said Contract Amount").

NOW IT IS HEREBY AGREED AS FOLLOWS:-

1. In consideration herein mentioned the Contractor will upon and subject to the conditions annexed carry out and complete the work shown upon the Contract, Drawing and described by or referred to in the Schedule of Quantities and in the said conditions.
2. The Employer shall pay the Contractor the said Contract Amount, or such other sum as shall become payable, at the times and in the same manner specified in the said Conditions.
3. The said conditions and Appendix thereto and the correspondence attached hereto shall be read and construed as forming part of this Agreement and the parties hereto shall respectively abide by, submit themselves to the said conditions and the correspondence and perform the agreements on their part respectively in the said Conditions and the correspondence contained.
4. The plans, agreement and documents mentioned herein shall form the basis of this contract.
5. This contract is neither a fixed Lump sum Contract nor a Piece Work Contract, but it is a Contract for the complete work to be paid for according the actual quantities at the rates contained in the Schedule of Rates and Probable Quantities or as provided in the said Conditions. The Contractor has to visit the site & acquaint himself with the site condition & also the part work done therein by the previous contractor. As the nature of the work comprises of completing the balance incomplete work, the new contractor should carefully study the present site condition & quote the rates accordingly, No claims will be entertained later for any lapse on the contractor’s part in having studied the present site condition.
6. The Contractor shall afford every reasonable facility for carrying out of all works or other Contractors appointed by the Employer and shall make good any damages done to walls, floors etc. after the completion of such works.
7. The Employer reserves to itself the right of altering the items to be executed by adding to or omitting any items without prejudice to this contract. However, the Contractor shall not be entitled to any payment for the works done exceeding the Tender Quantities unless specificallyapproved in writing by the Institute’s Engineer.

 8. Time shall be considered as the essence of this Contract and the contractor hereby agrees to commence the work job from 4th date of issue of work order as provided for in the said conditions and to complete the entire work within 2 months. Subject nevertheless to the provisions for extension of time.

 9 All payments by the Employer under this contract will be made only at Mumbai. All disputes arising out of or in any way connected with this Agreement shall be deemed to have arisen at Mumbai and only courts in Mumbai shall have the jurisdiction to determine the same.

1. That the several parts of this Contract have been read by the Contractor and fully understood by the Contractor.

IN WITNESS HEREOF the Employer and the Contractor have set their respective hands to these presents and two duplicates hereof the day and year first hereinabove written. (If the Contractor is a partnership or an individual)

IN WITNESS WHEREOF the Employer has set its hands to these presents through its duly authorized officials 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 duplicates 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

Indira Gandhi Institute of Development & Research by the

hands of

Shri ……

…………………………..

 (Name & Designation)

in the presence of

1. ………………………………….

Address…………………………………

**…………………………………………..**

1. **………………………………….**

Address ………………………………..

…………………………………………..

Witnesses

SIGNED AND DELIVERED BY If the party is a partnership firm or an individual

………………………………….. Should be signed by all or on behalf of all the

in the presence of partners.

1. …………………………………

Address ……………………………….

**………………………………………….**

1. **…………………………………**

Address ………………………………..

…………………………………………..

Witnesses

THE COMMON SEAL OF ………………

was hereunto affixed pursuant to

the resolution passed by its Board

of Directors at the meeting held on

……………………………………in the

presence of

1. ……………………………..….
2. ………………………………...

Directors, who have signed these If the Contractors signs under common

presents in token thereof in the seal, the signature clause should tally

presence of with the sealing clause in Articles of

 Association.

1. ………………………………………
2. **……………………………………...**

SIGNED AND DELIVERED BY the If the Contractor is signing by the hand of

hand of Shri …………………………… power of Attorney whether a company or

and duly constituted attorney an individual

**S E C T I O N `C’**

**GENERAL INSTRUCTIONS TO TENDERERS**

1. Sealed Tenders **in duplicate** should be addressed to Shri. Jai Mohan Pandit, Registrar, Indira Gandhi Institute of Development Research, Goregaon (East), Mumbai-400065. (by name) and superscripted ~**Tender for Air Conditioning Ducting & AHU work for Seminar Room-1, IGIDR, Goregaon Mumbai.**

 To reach him not later than 2 p.m. on  **2nd July, 2014** along with an Earnest Money of deposit **Rs. 25,000.00** by Demand Draft/Bank Guarantee drawn in favour of India Gandhi Institute of Development Research, of a Scheduled Bank.

The Tender shall be submitted in 2 envelopes. The first envelope should contain the Technical Bid (written in bold on the cover) comprising of Letter of offer, Articles of Agreement format, General Instruction to tenderers, special conditions, Appendix, Organization information duly filled in the attached format along with supporting documents as mentioned in qualification criteria & EMD. All pages shall be duly signed and stamped. The second sealed envelope to contain the price bid (To be written in bold on the cover). Both these envelopes to be inserted in a third envelope duly sealed & stamped.

The Technical Bid shall be opened first and the price bids of only the qualifying vendors shall be opened subsequently. The price bids may or may not be opened on the same day as may be decided by the Institute.

1. The scope of **Up gradation of Infrastructure Facilities-Air conditioning Ducting & AHU work for Seminar Room-1** workas defined in BOQ comprises of the following:
2. Supply and installation of AHU in Seminar Room No 1.
3. Supply and Installation of AC Ducting in Seminar Room No1
4. The tenderer must use only the forms issued by the Institute to fill in the rates. Any addition/alteration in the text of the tender form made by the tenderer shall not be valid and shall be treated as null and void. Bidder / Bidders will not be allowed to modify his / their bids once submitted. In case, such modifications are found / made, the bid shall be cancelled and E.M.D. shall be forfeited without prior notice to the bidder. Financial bid will be evaluated on the original Tender Form only If any correction with respect to the Tender Form other than the original are found, then the bid shall be cancelled without any prior notice to the bidder.
5. The tender form must be filled in English and all entries must be made by hand and written in ink. If any of the documents is missing or unsigned, the tender may be considered invalid by the Institute in its discretion.
6. Rates should be quoted both in figures and in words in columns specified. All erasures and alterations made while filling the tender must be attested by initials of the tenderer. Overwriting of figures is not permitted. Failure to comply with either of these conditions will render the tender void at the Institute's option. No advice whatsoever especially on any change in rate specifications after the opening of the tender will be entertained.
7. Each Page of the Tender Documents should be signed by the person or persons submitting the tender in token of his/their having acquainted himself/themselves with the General Conditions of contract. General Specifications, Special Conditions, etc., as laid down. Any tender with any of the documents not so signed will be rejected.
8. The tender submitted on behalf of a firm shall be signed by all the partners of the firm or by a partner who has the necessary authority on behalf of the firm to enter into the proposed contract or by a person holding the power of attorney in the case of a company. Otherwise the tender may be rejected by the Institute.
9. Employer’s right to accept any bid and to reject any or all bids: Notwithstanding anything contained above, the Employer reserves the right to accept or reject any bid or to reject all bids without assigning any reasons and without any obligation to inform the bidders of the grounds for the Employer’s action.
10. The Earnest Money deposit of Rs**. 25, 000.00** by a Demand Draft/ Bank Guarantee issued by a Schedule Bank drawn in favour of Indira Gandhi Institute of Development Research, Mumbai shall only be accepted by the Institute. A tender which is not accompanied by EMD i.e. demand draft/ Bank Guarantee will not be considered. The EMD will be returned to the tenderer if his tender is not accepted by the Institute but without Interest. The EMD paid by the successful tenderer shall be held/encashed by the IGIDR. as security for execution and fulfillment of the contract. No interest shall be paid on this deposit. The Earnest Money Deposit (EMD) of the successful tenderer shall be converted into Security Deposit (SD). 3% of the total value of work done will be withheld from their running A/C bills by the Institute as Retention Money (RM). The 50% EMD and 50% of Retention Money shall be released to the contractor on virtual completion and remaining 50% of EMD and RM amount shall be released after successful completion of 12 months of Defect Liability Period. In case of the contractor so request the balance 50% of Security Deposit (i.e. EMD + RMD) will be held in the form of Bank Guarantee of an approved scheduled Institute in the proforma to get approved by the employer till the satisfactory completion of defect liability/performance guarantee period of 12 months. The security deposit of the successful tenderer will be forfeited if, he fails to comply with any of the conditions of contract. No interest will be paid on Security Deposit withheld by the Institute.
11. Indira Gandhi Institute of Development Research does not bind itself to accept the lowest or any tender and reserves to itself the right to accept or reject any or all the tenders, either in whole or in part, without assigning any reasons for doing so. Indira Gandhi Institute of Development Research also reserves the right to divide the order between two or more tenderers and the contractor shall carry out even the part orders for various items.
12. Indira Gandhi Institute of Development Research reserves the right to sub-divide the work mentioned in the tender, amongst two or more contractors at its own discretion and the Contractor will have to execute orders for part of the items placed with them at the quoted rates. Indira Gandhi Institute of Development Research also reserves the right to increase or decrease the quantities and even omit any item of work after the order is placed and the Contractor shall execute the same without claiming anything extra for the same. In this context the rates quoted for each item must be self supporting and relevant.
13. . On receipt of intimation from the Employer of the acceptance of his/their tender, the successful tenderer shall be bound to sigh the formal Contract and within seven days thereof, the successful tenderer shall sign an agreement in accordance with the draft agreement and the Schedule of Conditions but the written acceptance by Indira Gandhi Institute of Development Research and the Contractor so tendering, whether such formal agreement is or is not subsequently executed. The cost of necessary Stamp paper for execution of the agreement shall be borne by the successful tenderer.
14. The Contractor shall not assign the contract. He shall not sublet any portion of the contract except with the written consent of the Employer. In case of breach of these conditions, the Employer may serve a notice in writing on the Contractor rescinding the contract whereupon the security deposit shall stand forfeited to the Employer, without prejudice to his other remedies against the Contractor.
15. The Contractor shall carry out all the work strictly in accordance with drawings, and design and as per detailed instructions of the Institute’s Engineer. If in the opinion of the Institute’s Engineer, changes have to be made in the design and with the prior approval in writing of the Employer they desire the Contractor to carry out the same, the Contractor shall carry out the same. The Institute’s Engineer's decision in such cases shall be final.
16. . A schedule of probable Quantities in respect of each work and Specifications accompany these Special Conditions. The Schedule of Probable Quantities is liable to alterations, as per Institute`s requirement. Each tender should contain not only the rates but also the value of each item of work entered in a separate column and all the amounts quoted against various items should be totaled in order to show the aggregate value of the entire tender.
17. The tenderer must obtain for himself on his own responsibility and at his own expenses all the information which may be necessary for the purpose of making tender and for entering into a contract and must examine the drawings, inspect the site of the work, acquaint himself with all local conditions, means of access to the work, nature of the work and all matters appertaining thereto. Since the contract comprises of completion of balance incomplete works from the previous contract, the contractor quoting shall visit the site & familiarize himself with the work already executed & the balance work to be executed under the new contract. Any extra claims on account of non understanding the existing site condition shall not be entertained later.
18. The rates quoted in the tender shall include all charges for packing, transport, loading, unloading and for delivery at site. The rates shall also be firm and shall not be subject to exchange variations, labour conditions, fluctuations in railway freights or any conditions whatsoever. Tenderers must include in their rates, work contract tax, sales tax, excise duty, octroi and any other tax and duty or other levy whether existing or future, levied by the Central Government or any State Government or Local Authority, if applicable. No claim in respect of sales tax, excise duty, octroi or other tax, duty or levy whether existing or future, shall be entertained by the Employer.
19. . The Contractor should note that unless otherwise stated the tender is strictly on item rate basis and his attention is drawn to the fact that rates for each and every item should be correct, workable and self supporting. The quantities in the Schedule of Quantities approximately indicate the total extent of work but may vary to any extent and may even be omitted thus altering the aggregate value of the contract. No claim shall be entertained on this account. **The contractor shall bring to the notice of the Employer in case of any extra items not mentioned in the schedule of quantities during the course of the work and shall only carry out the same on written approval from the Institute's Engineer.**
20. Time allowed for carrying out the work is 2 months, which shall be strictly observed by the tenderer and it shall be reckoned from the 4th day of issue of written order to commence the work. The work shall throughout the stipulated period of the contract be preceded with all the due diligence and if the Contractor fails to complete the work within the specified period he shall be liable to pay compensation at the rate of 1% per week subject to a maximum amount of 10% of the contract amount. The tenderer shall before commencing work prepare a detailed work program which shall be approved by the Institute's Engineer/ Consultant.
21. Tenders will be considered only from recognized bonafide manufacturers/contractors in the trade concerned and who are satisfying the minimum prescribed qualifications. Each tenderer shall submit with his tender a list of large works of a like nature he has executed giving details as to their magnitude and cost, the proportion of work done by the Contractor in it and the time within which the works were completed.
22. The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work, whatever the cause of delays may be, including delays arising out of modifications to the work entrusted to him or in any sub-contract connected therewith or delays in awarding contracts for other trades of the project or in commencement or completion of such works or in procuring government controlled or other building materials or in obtaining water and power connections for construction purpose or for any other reason whatsoever and the Employer shall not be liable for any claim in respect thereof. The Employer does not accept liability for any sum besides the tender amount, subject to such variations as are provided for herein.
23. The successful tenderer is bound to carry out any or all items of work necessary for the completion of the job even though such items are not included in the quantities and rates. Schedule of Instructions in respect of such additional items and their quantities will be issued in writing by the Employer. The rates for such extra items shall be worked out on the basis of a rate analysis considering the basic material prices with market discounts plus labour cost plus the profit & overheads component of 15% over the material & labour cost.
24. The successful tenderer must co-operate with the other contractor appointed by the Employer so that the work shall proceed smoothly with the least possible delay and to the satisfaction of the Engineer. The contractor is responsible for the protection of the materials ordered by him & stored on the site against any theft, damage on account of natural elements like rain, storms, etc & should take proper precaution to cover the same.
25. The rates for all RCC, Masonry, Plaster & other Civil items to include that for necessary scaffolding, staging, platforms, curing etc as per the directions of the engineer in charge.
26. DEFECT LIABILITY PERIOD OR PERFORMANCE GUARANTEE PERIOD: Any defect or fault which may appear during 12 months from the date of virtual completion of work/or supply, installation & Performance in full as specified under the contract, arising in the opinion of the Institute's Engineer from materials or workmanship not in accordance with the contract, shall upon the directions in writing of the Institute's Engineer, and within such reasonable time as shall be specified therein, be amended and made good by the Contractor at his own cost and in case of default the Institute may employ and pay other persons to amend the make good such defects/faults and damages, loss and expenses consequent there upon 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 Institute, or may be deduced by the Institute upon the Institute's/Institute`s Engineers' certificate in writing from any moneys due or that may become due to the contractor. The contractor/supplier shall remain liable under the provisions of this clause notwithstanding the signing by the Institute's Engineer any certificate or passing of any accounts.
27. All erasures and alterations made while filling the tender must be attested by initial of the tenderer. Overwriting of figure is not permitted. Failure to comply with any of these conditions will render the tender void. No advice of any change in rate or conditions after the opening of the tender will be entertained.
28. Each tender should contain not only the rates but also the value of each item of work entered in a separate column and all items should be totaled up to show the aggregate value of the entire tender.
29. The Contractor shall arrange to get all the samples of materials to be used in the work approved from the employer.
30. Time shall be considered as the essence of the contract. Indira Gandhi Institute of Development Research reserves the right to terminate the Contract if the contractor fails to execute the job within the specified period or fail to keep the programme of work as per the programme given by the contractor and approved by Institute.

Procedure for Termination:-

**Notice to Correct**

If the Contractor fails to carry out any of his obligations, or if the Contractor is not executing the Works in accordance with the Contract, the Engineer may give notice to the Contractor requiring him to make good such failure and remedy the same within a specified reasonable time.

**Termination**

If the Contractor:

(a) Fails to comply with a notice issued by Engineer.

(b) Abandons or repudiates the Contract.

(c) Without reasonable excuse fails:

to commence the Works in accordance with Letter of Acceptance,

to proceed with the Works in accordance

 (d) Becomes bankrupt or insolvent, goes into liquidation.

(e) Fails to comply with a notice issued, within 7 days after having received it, or

(f) Assigns the Contract or Subcontracts the Works without the required consent.

Then the Employer may, after having given **7 days' notice to the Contractor**, terminate the Contractor’s employment under the Contract and expel him from the Site. The Contractor shall then deliver all Construction Documents to the Engineer. The Contractor shall not be released from any of his obligations or liabilities under the Contract. The rights and authorities conferred on the Employer and the Engineer by the Contract shall not be affected.

The Employer may upon such termination complete the Works himself and/or by any other Contractor. The Employer or such other Contractor may use for such completion so much of the Construction Documents, Contractor’s Equipment, Temporary Works, Materials as he or they may think proper, upon completion of the Works, or at such earlier date as the Engineer thinks appropriate. The Engineer shall give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall remove or arrange removal of the same from such place without delay and at his cost

**Valuation on Date of Termination**

The Engineer shall, as soon as possible after termination, determine and advise the Contractor of the value of the Construction Documents, Materials, and Works and all sums then due to the Contractor as at the date of termination.

**Payment after Termination**

After termination, the Employer shall not be liable to make any further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Contractor, have been established.

The Employer shall be entitled to recover from the Contractor the extra costs, if any, for completing the Works after allowing for any sum due to the Contractor. If there are no such extra costs the Employer shall pay any balance to the Contractor.

1. Mode of payment:

On account bills shall be made as under detailed item wise measurement will be taken and payment shall be made based on completion of specific item of work basis on the quoted rate. All payment shall be subject to recovery of 5% towards security deposit, Retention money income tax and work contract tax. On account payment to the extent of 75% of the total amount of running bill can be paid to the contractor if deemed fit and approved by the institute’s engineer and consultant architects representative.

1. Material advance shall not be paid, however the contractor after supplying the material on the site can claim a running bill and the material value can be claimed as a percentage of the item rate and as approved jointly by the Institute’s Engineer, the Project Management consultants and the Contractor’s Engineer. The amount worked out as above should in no case be less than the minimum amount bill value stipulated under this contract.
2. Contractor shall note that the interim value of work done towards payment of running bill is **Rs. 3 lakhs.**
3. The item wise measurements of work have to be done and quantities have to be worked out for the accurate assessment of the total cost of renovation before quoting.
4. In all matters of dispute arising on the work, the matter shall be referred to Registrar Indira Gandhi Institute of Development Research, Goregaon or decision. If this decision is not acceptable to the party, then the same shall be settled as per the arbitration act.
5. Delivery schedule shall clearly be indicated in the quotation submitted by the supplier. Penalty at the rate of 0.5% or part thereof of the order value per week, subject to a maximum of 2.5% will be imposed for delayed delivery and installation
6. Insurance Clause:

The Contractor shall be responsible for all injury to person, animals or things and for all structural and decorative damage to property which may arise from the operation or neglect of himself or of any nominated sub-Contractor’s employees, whether such injury or damage arise from carelessness, accident or any other case whatever in any way connected with the carrying out of the contract. This clause shall be held to include, inter-alia, any damage to buildings whether immediately adjacent or otherwise, and any damage to road, streets, footpaths, bridges or ways as well as all damage caused to the buildings and works forming the subject of this contract, by frost or other inclemency of weather. the Contractor shall indemnify the employer and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any Acts of government or otherwise and also in respect of any award of compensation or damages consequent upon such claims. The Contractor shall reinstate all damages of every sort mentioned in this clause, so as to deliver up the whole of contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property or third parties.

The Contractor shall indemnify the employer against all claims which may be made against the employer by any member of the public or other third party in respect of anything which may arise in respect of the works or in consequence thereof and shall at his own expenses arrange to effect the maintain until the virtual completion of the contract with an approved office, policy of insurance in the joint names of the employer and the Contractor against such risk and deposit such policy or policies with the employer from item to time during the currency of this contract. The contract shall also similarly indemnify the employer against all claims which may be made upon the employer whether under the workmen’s compensation act or any other statutes in force during the currency of this contract or act Common Law in respect of any employee of the contractor or any sub-contractor and shall at his own expense effect and maintain, until the virtual completion of the contract, with an approved office a policy of insurance in the joint names of the Employer and the contractor against such risks and deposit such policy or policies with the Employer from time to time during the currency of the contract.

The minimum limit of the coverage under the third party insurance policy shall be Rs. 2 lakhs person for any one accidental or occurrence and Rs. 5 lakhs in respect of damage to property for any one accident or occurrence.

The Contractor shall be responsible for anything, which may be excluded from the insurance policies above referred to and also for all other damages to any property arising of and incidental to the negligent or defective carrying out of this contract. He shall also indemnify the Employer in respect of any costs, charges or expenses arising out of claim or proceedings of damage arising there from.

The Employer shall be at liberty and is hereby empowered to deduct the amount of any damage compensation, costs, charges and expenses arising occurring from or in respect of any such claims of damage from any or all sums due or to become due to the Contractor.

In addition to the above, the Contractor shall insure the work against loss due to fire, for the entire contract amount with an approved insurance company till the virtual completion of the work.

I/We hereby declare that I/we have read and understood the above instructions and the same will remain binding upon me/us in case the work is entrusted to me/us.

Place: Signature of Bidder

 With the seal of their company

Date :

**SPECIAL CONDITIONS**

1. The workmen will not be allowed to stay within the premises.

1. The water required for the work or workmen cannot be availed from the site .Contractor has to make arrangements independently.
2. The electric power required for the work can be drawn from the supply available at site on the condition that expenses shall be borne by the contractor. The electric meter to be installed at the site by the contractor at his own cost.
3. Permission if any, required from the local bodies shall be obtained by the contractor at his cost.
4. The intending tenderer can obtain any clarifications regarding the tender drawings, specifications etc. if any from the office of the Registrar , Indira Gandhi Institute of Development Research, Goregaon, Mumbai 400 065 on any Institute`s working day.
5. The entire materials for the work shall be brought to the working area through the staircase only.
6. Wherever the basic rate for the material is specified, the contractor should provide to the Institute for verifications all paid bills of purchased materials for ascertaining the actual rate of purchase so as to settle the difference in cost of material. The rate shall be got approved from the Institute before purchasing. The adjustment in price of materials shall be made on measured quantity with 5% allowance for wastage. No overhead or profit shall be considered on the cost difference. The basic price for the materials shall be taken as the cost of material at dealer’s godown and transportation, loading and unloading charges etc. shall be included in the lump-sum rate quoted for each item

.

1. The debris/dust or any wastage generated out of the above work shall be cleaned as frequently as required and as instructed by the Institute’s Engineer away from the Institute’s premises.
2. The tenderer shall use only approved brand materials.

10. A qualified, experienced in Renovation and responsible full time engineer shall be posted at site who can receive instructions, maintain account of materials etc. take decisions at site, without waiting for the instructions of the contractor.

11. No lapses from the Contractors side, which may cause damage to the property and injury to the occupants/neighbors in the opinion of the Institute’s Engineer, shall be permitted.

12. The work has to be carried out with least inconvenience to the staff.

13. Programme should be submitted before commencement of work so as to enable the Institute to intimate the Departments in advance for smooth working and better progress and the time schedule should be strictly adhered to.

14. No labors shall be permitted to stay inside the campus after working hours. Contractor to make provision for the stay of his labor outside the premises at his own cost & the rates quoted to include the cost for the same.

15. The Contractors has to obtain permission from the local authorities as per the existing local bye laws for such works and the charges/fees if any, has to be borne and paid by the contractor including water and draining charges.

16. The contractor should have valid labour license from Labour Commissioner wherever the number of laborers’ engaged is 20 or more.

17. Sales Tax on works contract shall be deducted as per Works Contract Act 1989 (as amended) at source. The rate quoted shall include all such taxes and levies.

18. The contractor shall have the addresses and photographs of their workmen being engaged by them for the said work. The entry of workmen will be allowed inside the building only on producing the photo pass issued by the Institute’s Caretaker.

19. Before quoting the rates contractor should inspect the site and understand themselves about the nature and scope of the work.

20. Any damage cause to any of Institute’s properties shall be made good by the contractor at their own cost.

21. The contractor shall carry out the work strictly in accordance with specification details and instructions of the Institute’s Engineer.

22. The Contractor shall make their own arrangements for storing of their materials at site.

23. Contractor shall keep the Institute indemnified against all claims, if any.

24. If any civil work is involved for installation of this system, the contractor shall intimate the institute at least 10 days in advance to ensure necessary approval procedure and execution.

Place:

Date:

Signature of Contractor with seal

**APPENDIX**

Earnest Money Deposit Rs. 25,000.00/-

Defects Liability/Performance

Guarantee Period 12 months.

Period of final measurement 15 days.

Date of commencement 4th day from the date of issue of work order.

Date of completion 2 months from the date of commencement

Liquidated damages Rs. 1% of the cost of the work per week (subject to a max. of 10% of the value of work actually executed/ accepted contract value)

Value of work for interim certificate Rs.3, 00,000.00 (Rs. 3 Lacs)

Retention percentage 3% of each R. A. Bill Amount.

Total Security Deposit

(EMD + Retention Money) 5% of the contract value.

Payment after virtual completion 50% of the aggregate of the Security

 Deposit amount actually retained.

 The balance after defect Liability period

 as mentioned above is over.

Place : Signature and seal of Contractor with Seal

Date :

**TENDER FOR AIR-CONDITIONING WORKS**

**1.0 GENERAL**

1.1 This specification covers in brief the technical requirements for the supply of Equipment, materials, installation, testing and commissioning of the Air Conditioning

 and ventilation equipments and systems for Hotel Cruise herein eferred as Client for their

 Project

**2.0 PROJECT INFORMATION**

M/s. Indira Gandhi Institute, Goregaon is proposing the retrofit work for their Seminar Hall No 1 in the said institute. The retrofit work includes supply, installation, testing & commissioning of the AHU with the ancillary works.

**3.0 BASIS OF DESIGN & DIVISON OF WORK**

**3.1 HVAC REQUIREMENTS**

The HVAC requirement proposed are as under:

Air conditioning for Seminar Hall No 1

**3.2 DESIGN CONDITIONS**

The outdoor design conditions are based on the weather data and design condition

Are as shown below:

Location: Mumbai

Latitudes: 18.32 Deg North

Altitude: 559 m above msl

Daily range: 17 Deg C

**3.3 DESIGN WEATHER DATA:** DB (Deg C) / WB (Deg C)

i Summer 35 / 28.3

ii Monsoon 29.4 / 27.8

iii Winter 18.3 / 14.4

**3.4 INSIDE CONDITIONS:** DB (Deg C) WB (Deg C)

 24 + 1 with 55% Relative Humidity

3.5 Automatic control for the temperature shall be provided. However, there shall be

 no humidity control and hence the RH during monsoon may go up.

3.6 Chiller inlet water temperature : 5.6 Deg C

 Chiller outlet water temperature : 8.6 Deg C

**3.7 HEATLOAD CALCULATIONS**

 The work sheet of heat load calculations is attached with this document.

**4.0 GENERAL TERMS AND CONDITIONS OF CONTRACT**

4.1 The he total responsibility of the entire work, covered under this specification, shall be

 With the Contractor.

4.2 Contractor's scope shall also include storing and maintaining, handling the equipment/

 Materials being supplied by the client as well as by the Contractor Himself.

4.3 The Contractor shall make available the necessary qualified and experienced

 Supervisory staff and experienced fitters, welders, skilled, Semi-skilled /un-skilled

 Personnel to complete the job in an expeditious manner.

4.4 The necessary machinery, tools, tackles, consumables, instruments, etc. required

 For carrying out the job shall be made available at site by the contractor. Necessary

 Scaffolding, ladders, tools, tackles, consumables is to be arranged by the contractor at no

 Extra cost. Safety as per company rule will be followed.

**4.5 SITE FACILITIES**

4.5.1 The client shall provide free of cost, open space to the contractor for setting up his

 Site office and storage.

4.5.2 The client will supply at one point free of cost.

 a) Water

 b) Electricity

4.6 Security of the materials brought inside the premises by the Contractor or materials

 Issued by the Purchaser to the Contractor, shall be the full responsibility of

 The Contractor.

4.7 Providing scaffolding, life safety belts, ladders, shock proof helmets, rubber hand

 Gloves, rubber shoes, fire fighting devices, etc. shall be provided at site by the

 Contractor as a measure of safety to avoid any accident.

4.8 Rates quoted by the bidder shall be inclusive of all taxes, duties, levies, octroi or any

 Other charges. The same shall be firm throughout the tenure of contract. No price

 Rise what so ever shall be paid. Owner reserves his right to procure any of equipment & give the same to contractor for installation.

4.9 The client shall not be responsible in any way for any damages or compensation, payable in consequence of any accident or injury, to any of the contractor's personnel.

4.10 The Contractor shall be completely responsible and shall arrange for a suitable Insurance / workman’s compensation policy or any other policy as per (as directed By Engineer-in-Charge at site) at his cost to cover workmen and supervisory staff of his

 Company or any of his sub-contractor's personnel under Employer's Liability Act and

 Shall indemnify the Purchaser against any claims, demands, proceedings costs, charges

 And expenses, whatsoever in respect thereof or in relation thereto.

4.11 It shall be the responsibility of the Contractor to obtain necessary license /Authorization / Permit for work from the Licensing Board of the locality/State where the work is to be carried out. The persons deputed by the Contractor's firm should Also hold valid permits issued or recognized by the Licensing Board of the locality / State where the work is to be carried out.

4.12 The Contractor shall co-operate through the client/Engineer with other contractors, agencies at site, in all matters of common interest, so as not to obstruct operation of others and to ensure the safety of all personnel and work covered under this specification.

4.13 The list of recommended manufacturer's names for various equipment is given in under List of Recommended makes.

4.14 For items supplied by client to contractor, client shall issue these items to the contractor as and when required which will then be in the security of the contractor.

4.15 The contractor shall submit a bar chart indicating all activities to be completed in his scope of work within 10 days of placement of PO/LOI and get the same approved from

 the Client / Consultant.

4.16 The contractor shall abide by the statutory laws of local authorities and safety regulations of the client.

4.17 Crane facility shall not be provided by the client.

4.18 For any additional work required by the client, for which rates are not established, the Contractor shall submit Rate Analysis and obtain client’s approval before taking

 up such additional work.

4.19 In case of any change in scope or in the event of non-availability of clear fronts for

 work, the contractor shall inform the client in writing and obtain the extension to

 the completion period. In such cases the liquidated damages will not be applicable.

**4.20 GUARANTEE**

4.20.1 All the work executed by the Contractor shall be guaranteed for the period of 12

 months from handing over the installation.

4.20.2 In case of any part of work is found deviated from the specifications and or commitments made by the Contractor the same shall be rectified immediately without

 any extra charges.

4.20.3 Any defect arising with the material supplied and workmanship shall be corrected within

specified time by the Contractor at his own cost and extension of guarantee correspondingly for such work.

**4.21 PERIOD OF COMPLETION OF WORK**

4.21.1 The Contractor shall commence the work on or before the date so mentioned in the work

order and shall complete it to the entire satisfaction of the client/Consultant in conformity with such instructions as the client/Consultant and/or his Engineer may from time to time, give, and hand it over to the Purchaser on completion. The scope of work covered under this specification shall be completed in 2 months from LOI

4.21.2 On the work being awarded, the Contractor must submit a detailed programme for the

 execution of the several component items of work covered by the contract, consistently with the overall time schedule for completion of the entire work. The contractor shall thereafter, submit to the client/Consultant progress of work done, at such

intervals as may be prescribed by the client/Consultant. He shall also furnish to the client/Consultant, the programme of work he proposes to take up and complete during the following week. The said programme will be subject to alterations or modifications as the client/Consultant may, in his discretion, make. The client may discuss such modifications or alterations with the Contractor if he considers it necessary.

4.21.3 Completion of the work aforesaid shall be deemed to be of the essence of the contract & if

the Contractor fails to complete the work within the time prescribed; the client shall be entitled without prejudice to any other right or remedy available to it on that behalf, to recover by way ascertained and liquidated damages, a sum equivalent to one per cent (1%) of the contract value of the work for each week or part of a week by which the Contractor is in default, subject to max 5% of contract value, and allow the Contract or such extensions of time as it may in its discretion decide. The client shall also be entitled, without prejudice to any other right or remedy available to it on that behalf to appropriate the Contractor’s Security Deposit whether or not actual damage has been caused by such default. In case of any change in scope or in the event of non availability of clear fronts for work, the contractor shall inform the client in writing and obtain the extension to the completion period. In such cases the liquidated damages will not be applicable.

**4.22 PAYMENT TERMS**

(a) As per R.A. Bill.

**4.23 INSPECTIONS**

i) All material and work shall be subject to inspection, examination and test by the client at

any and all times during manufacture or construction. The client will have the right to reject defective material and work. The Contractor shall correct and replace rejected material with proper material at his own cost & to the full satisfaction of the client. If the Contractor fails to proceed at once with the replacement of rejected material or the correction of defective, work the Purchaser may, through a fresh Contractor or otherwise and at the risk and cost of the Contractor, replace such material or correct such work.

ii) The Contractor shall furnish promptly, without charge, all facilities, labour & materials, instruments and appliances, necessary for any inspection, examination & tests

 will be carried out in such manner that the work will not be delayed.

iii) The decision of the client / Consultant in regard to the quality of work & materials &

conformance to the specifications and drawings shall be final.

**4.24 MEASUREMENT OF WORK & DETERMINATION OF QUANTITIES FOR PAYMENT**

i) Measurement of work done by the Contractor will be recorded by the client after notice to the Contractor. The Contractor or his agent, if present, shall sign the measurement book as token of acceptance of the measurement as recorded therein. If the Contractor or his agent be not present, measurements will be recorded by the client in their absence and such record shall be final and binding on Contractor.

ii) The quantity of work to be paid for any item for which a unit price has been fixed, the Contractor shall be paid for the actual amount or number as determined by the client, for units of work completed in accordance with the specifications & contract and as directed pursuant thereto and to the satisfaction of the Purchaser. No payment shall be made for any work done other than in strict conformity with the specifications.

 iii) The contractors or their representative shall accompany the consultant or his representative or the clerk of works when required to do so & assist in taking the measurements & shall agree to the measurements recorded on the spot.

iv) All measuring tapes shall be of steel and scaffolding & ladders that may be required for taking measurements should be supplied by the contractor.

v) If the contractors fail to accompany the clerk of works or any other person that has been duly authorized by the consultant to take measurements, they shall be bounded by the measurements recorded by the Consultant or his representative.

**4.25 TERMINATION OF CONTRACT BY PURCHASER**

In case during the execution of work, the quality of work executed is not as per the specifications mentioned in the contract or if the progress of works is not satisfactory according to the contract provisions then on recommendations of consultant the client shall be at liberty to terminate the above contract or the client may on its own terminate the contract with 15 days notice to the Contractor.

4.26 Scope of the work includes for the items mentioned in the tender, detailed in Schedule of Quantities & shown in the drawings. Contractor to include items not covered but required for completion of entire job as a whole.

4.27 Any civil work such as excavation making hole, chasing in wall/column/floor etc for taking cable or pipe and after completing the work making good & finishing of the same to original shape is also deemed to be included in the scope of the contractor and no extra payment will be paid on account of the same.

4.28 The contractor shall visit the site & shall satisfy himself as to conditions under which the work is to be performed. No extra claim consequence of ignorance or on grounds of insufficient description will be allowed at a later date. Any deviations from specifications to be listed out specifically.

**4.29 SCHEDULE OF QUANTITIES & RATES.**

The rates for supply and installation shall be as per schedule of quantities, specifications and construction drawings.

 The rates quoted are on F.O.R. SITE basis and shall include all taxes, duties, levies,

 conveyance & handling etc, including works contract tax.

For any additional work required by the Purchaser, for which rates are not established, the Contractor shall submit Rate Analysis and obtain Purchaser's approval before taking up such additional work.

The tender drawings are prepared based on architectural drawings & expected equipment sizes. While issuing the drawings of “Released for construction” status, the revision / changes will be incorporated as per detailed drawings.

**4.30 WORK PROGRAM**

The contractor on starting the work shall furnish to the Consultant a program for carrying out the work stage by stage in stipulated time. A graph or chart on each individual work shall be maintained showing the progress week by week. A copy of the same to be submitted to the employer.

**4.31 WORK PROGRESS REPORTS**

The contractor shall furnish all particulars for the compiling of the progress reports to the clerk of works. The contractors are to take care in loading and unloading materials for the work, that the road and foot paths are not obstructed or the traffic impeded, and they must confirm with the police regulations for carrying, loading and unloading all materials, plant, earth, debris etc. to and from the building. All rubbish as it accumulates from time to time during the progress of the works, and at completion, including that of sub-contractors is to be cleared away, and all materials condemned by the Consultant are to be removed from the work, within forty-eight hours. The consultant shall have full powers and authority to issue such instructions as to the order or proceeding with or carrying out the work as he may deem necessary for guidance of contractor and the consultant on any person or persons authorised by the Consultant to give such instructions.

**5.0 TECHNICAL SPECIFICATIONS**

**5.1 AIR HANDLING UNIT**

**5.1.1 SCOPE**

This specification covers the general design, materials, construction features, manufacture, shop inspection & testing at manufacturers works, delivery at site, handling at site, installation, testing, commissioning & carrying out performance test at site of Air Handling Units (AHU’s). **The CONTRACTOR should physically check the floor space in the AHU room before ordering the AHU.**

**5.1.2 CODES & STANDARDS**

The design, materials, manufacture, inspection, testing and performance of the 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 & Ventilation

 purposes.

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

 ARI 410 Forced circulation air cooling & 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 & Ventilation Systems.

**5.1.3 GENERAL**

A Design Criteria

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

 ii All coils shall be rated, tested & 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 & certified in accordance with AHSRAE Standard 52.

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

 vii All instrumentation & controls shall be commercial quality.

B Submittals : In addition to the standard requirements, provide the following with

 the Bid

 i Estimates of inlet & 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 & motor

 horse power 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 & installation requirements.

 iv Data for each filter type : Complete certified performance data at design

 conditions including volumetric flow rate & 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 &

 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 miles per second rms for belt-driven units. Measurements shall be taken in a direction parallel to the shaft in a

 horizontal plane & in a direction perpendicular to the shaft in both the

 horizontal & 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

 Floor Mounted 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 1.2 mm thick pre-coated GSS sheet for outer skin & plain GSS sheet for inner skin of the unit. All the panels shall incorporate 50 mm thick PUF insulation 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. Outlet Velocity of the fan should not be more than 8 - 8.5 m/s**

The entire frame work shall be mounted on a 100 mm (minimum) aluminium 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 & 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 & gaskets shall be concealed.

AHU’s shall have hinged quick opening insulated access door on fan & 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. 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 AHUs, serrated rubber pads shall be provided for vibration isolation. Casing shall be of air-tight construction and sufficiency rigid to exclude vibrations throughout the working capacity range of AHU.

**D COMPONENTS OF THE AIR HANDLING UNITS**

 The Air Handling Units shall consist of the following sections for the AHU.

I Components

 a Filter Section with Pre-filter of efficiency 90% down to 10 Microns by Gravimetric test (EU-3 or better) of efficiency as specified below under filter section

 b Chilled Water Cooling Coil Section

 c Fan Section (Should be AMCA Certified). Fan to be insulated with 20 mm Elastomeric Rubber insulation. Fan should be designed with max 8 to 8.5 m/s

 velocity

II Accessories

 a 1 Set of Vibration Isolators (Rubber Pads) for Air Handling Units.

 b 1 Set of Canvas cloth with zip apart from the one provided at the outlet of

 the Fan section in the Air Handling Units.

 c 1 Set of Commissioning Filters for AHU

III Documentation

 3 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.

**5.1.4 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 & comply with the requirements of MCA certified ratings program. The fan shall be of **backward / forward curved airfoil blades** of no overloading characteristics, double inlet double width type (DIDW). Outlet Velocity of fan should be designed at max 8 to8.5 m/s. 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 & 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 & 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 flexible connection to avoid any vibration from the unit on to the ducts. **The fan speed** **shall not exceed 1000 rpm & fan outlet velocity shall not exceed 8 - 8.5 meters** **/ second.** Fan motor shall be totally enclosed fan-cooled type & 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.

**5.1.5 MOTOR & DRIVE**

The motor shall be as per I S : 325 and with class "F" insulation, totally enclosed fan cooled, horizontal induction foot mounted type & rated not to draw starting current more than 6 times normal running current. 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. The rating should not exceed more than 7.5 kW / 10 HP. Drive to fan shall be provided through belt drive arrangement. Belts shall of the oil-resistant type. The motor shall be capable of handling the required starting torque of the pumps. Speed of the motor shall be compatible with the speed of the pump. The cooling fans shall be directly driven from motor shaft. Motor situated outdoors or exposed to the weather shall be weather protected. Motors shall be enclosed type & shall have dust tight construction with suitable means of breathing & of drainage to prevent accumulation of water from condensation. Drain holes shall exclude bodies greater than 6 mm diameter. All components shall be of adequate mechanical strength, robustness & shall be constructed of metal unless otherwise approved. All motors shall be dynamically balanced. The enclosure shall be designed to provide an effective sealing between the primary & secondary air circuits. Motor winding shall be vacuum impregnated with heat & moisture resistant varnish glass fiber insulated. Two independent earthing points shall be provided in accordance with IS:3043 on opposite sides of the motor for bolted connection. The cable boxes & termination shall be designed to enable easy disconnection & replacement of cables. (Motor should be part of scope with manufacturer & should not be supplied separately by ACMV Contractor)

**5.1.6 CHILLED WATER COIL SECTION & MOISTURE ELIMINATOR**

The coil section of the AHU shall be of the cartridge type, removable from the side of the casing & supported over the entire length of the coil. The Cooling coil section shall have 12.5 to 15 mm dia copper tubes minimum of 24G thick sine wave aluminum fins firmly bonded to copper tubes assembled in zinc coated steel frame. Face & surface area shall be such as to ensure rated capacity from each unit & such that air velocity across each coil shall not exceed 2.4 m/sec. Where required, eliminator shall be provided downstream 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 anywhere 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/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 & 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 carryover of moisture. Eliminator blades should be made of stainless steel & are assembled within a heavy gauge galvanized steel frame.

**5.1.7 FILTER SECTION**

The Filter Section shall consist of Pre-filters (EU 3). 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.

**5.1.8 DRAIN PAN**

The Insulated drain pan shall be constructed using stainless steel of 18G 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 32 mm in dia.

**5.1.9 SAFETY FEATURES**

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.

**5.1.10 ACCESSORIES**

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

 Inspection Window

 Bulkhead lightning.

**5.1.11 LIGHTING INSIDE THE AIR HANDLER**

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

**5.1.12 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.

**5.1.13 TESTING, ADJUSTING & BALANCING**

 Cooling capacity of the air handling unit shall be computed from the measurements of airflow & dry & wet bulb temperature instruments. An anemometer & 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 & quoted ratings. Power consumption shall be computed from measurement of incoming voltage and input current.

**5.1.14 IMPORTANT NOTE**

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

**5.2 SHEET METAL WORK**

**5.2.1 DUCTING**

The scope of this section comprises supply fabrication, installation and testing of all sheet metal / aluminium AC ducts. Unless otherwise specified here, the construction, erection, testing & performance of the ducting system shall conform to the SMACNA-1995 standards (“HVAC Duct Construction Standards – Metal & Flexible – Second Edition – 1995”-SMACNA)

All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I. raw material furnished. Galvanising shall be of 120gms/sqm (total coating on both sides) In addition, if deemed necessary, samples of raw material, selected at random by owner’s site representative shall be subject to approval and tested for thickness & zinc coating at contractor’s expense. The G I raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross section dimensions. All transverse duct connectors (flanges/cleats) and accessories/related hardware are such as support systems shall be zinc-coated (galvanized). All ductwork including straight sections, tapers, elbows, branches, shoe pieces,

collars, terminal boxes and other transformation pieces must be Rolastar /equivalent factory fabricated or by equivalent technology. Equivalency will require fabrication by utilizing the following machines and processes to provide the requisite quality of ducts and speed of supply.

Coil lines to ensure location of longitudinal seams at corners / folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any face side of the duct. All ducts, transformation pieces and fittings to be made on CNC profile cutters for required accuracy of dimensions, location and dimensions of notches at the folding lines. All edges to be machine treated using lock formers, flangers & roller for turning up edges.

Sealant dispensing equipment for applying built-in sealant in Pittsburgh lock where sealing of longitudinal joints are specified. Duct Construction shall be the Rolamate in compliance with 1” (250 Pa) wg static norms as per SMACNA. All transverse connectors shall be the Rolamate 4 bolt slip – on flanges system (supplied by Rolastar) or equivalent imported makes of similar 4 bolt systems with built in sealant. Non toxic, AC-applications grade P.E. or PVC Gasketing is required between all mating Rolamate flanged joints. Gasket sizes should conform to flange manufacturer's specification.

**DUCT CONSTRUCTION**

The fabricated duct dimensions should be as per approved drawings & all connecting sections are dimensionally matched to avoid any gaps. Dimensional Tolerances : All fabricated dimensions will be within + 1.0 mm of specified dimension. To obtain required perpendicularity, permissible diagonal tolerances shall be + 1.0 mm per meter. Ducts shall be straight & smooth on the inside. Longitudinal seams shall be airtight and at corners only, which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice to ensure air tightness. Changes in dimensions & shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitters shall be installed in all bends & duct collars designed to permit the air to make the turn without appreciable turbulence plenums shall be shop/factory fabricated panel type & assembled at site. The deflection of transverse joints should be within specified limit for rectangular duct deflection as given in SMACNA. Reinforcement of ducts shall be achieved by either cross breaking or straight

beading depending on length of ducts. A completely galvanized system consisting of fully threaded rods, slotted angles or double L bottom brackets (made out of 3.0 mm M.S. sheet), nuts, washers & anchor bolts as supplied by Rolastar / equivalent.

 **Table 1 : Support for Horizontal Duct - Rectangular**

|  |  |  |  |
| --- | --- | --- | --- |
| Sr No | Maximum DuctSize (mm) | Hanger Rod Dia | Interval (mm) |
| 1 | Up to 700 | 6 mm | 2400 |
| 2 | 701 - 1200 | 8 mm | 2400 |
| 3 | 1201 - 2000 | 10 mm | 2400 |
| 4 | Above 2000 | 12 mm | 2400 |

Additional supports wherever considered necessary by the consultant / engineer in charge shall be provided. Supports shall be taken from steel members grouted in the RCC work & fixing of steel members shall involve minimum damage.

The entire supporting system shall be meet with the approval of the Engineer in charge.All duct supports, flanges; hanger shall be given two coats of red oxide before installation. Where ducts are connected to the wall, such connections shall be made through mild steel frame fixed to the wall through suitable shear fasteners.

**Tools and tackles for site work**

The duct installation shall conform to SMACNA norms. For duct assembly & installation the use of suitable tools and tackles should be used to give the required duct quality and speed of installation including (but not restricted to) Electric Pittsburgh Seamer – used for closing Pittsburgh joints Electric Slitting shear – to make cut-outs Drilling machine with drill bits – for drilling holes in sheet metal work Hammer drill machine with drill bits – for drilling holes in building structures for anchors Hoisting system – for lifting the duct assembly up to mounting heights All ducts shall be installed as per tender drawings & in strict accordance with approved shop drawings to be prepared by the Contractor. The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these specifications and drawings. The work shall meet with the approval of Owner’s site representative in all its parts & details. All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building whether or not the same are shown on the drawings. Where there is interference/fouling with other beams, structural work, plumbing & conduits, the ducts shall be suitably modified as per actual site conditions. Ducting over false ceilings shall be supported from the slab above, or from beams. In no case shall any duct be supported from false ceilings hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractor’s work in the building. Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick appropriate insulation around the duct and totally covered with fire barrier mortar for complete sealing. All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge.

**Flexible aluminum ducting**

The ducting shall be insulated flexible shall be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix duct shall be in tear and puncture resistant construction. Care must be taken to install all the flexible duct in fully extended position and bends made with adequate radius as per manufacturer recommendation practices.

**DOCUMENTATION & MEASUREMENT FOR DUCTING**

All ducts fabricated and installed should be accompanied & supported by following documentation :

For each drawing, all supply of ductwork must be accompanied by computer generated detailed bill of materials indicating all relevant duct sizes, dimensions and quantities. In addition, summary sheets are also to be provided showing duct area by gauge & duct size range as applicable.

Measurement sheet covering each fabricated duct piece showing dimensions & external surface area along with summary of external surface area of duct gauge wise. All duct pieces to have a part number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy & proper site measurement, verification and approvals.

**5.2.2 TECHNICAL SPECIFICATIONS OF DAMPERS**

Provide 18G louver type dampers of robust construction. Design, method of operation, etc. shall be suitable for the location & service required. Provide suitable links, levers & quadrants required for proper operation & control of settings in any position. Dampers & other operating devices shall be made easily operable & accessible through access doors in ducts. Every damper shall have an indicating device clearly showing the damper position. Provide dampers in main ducts & for all branch connections even if not indicated on drawings for volume control & balancing of the system.

 The GUIDE VANES shall be provided as mentioned below :

 i At every non-split branch take off

 ii At every bend/elbow of less than 1.3 R/D ratio

 iii At first 4 collars after the fans and first two collar after every bends.

The vanes shall be double walled & properly curved for smooth airflow & change in direction of flow & shall be fabricated out of 0.8 mm thick sheet. The vanes shall be fixed to the side runners at equidistant & reverted/bolted to the ducts.

The SPLITTER DAMPERS shall be double walled aerofoil blade fabricated out 1.6 mm (16 SWG) GI sheet. The damper shall be complete with flanged sheet metal enclosure to suit the upstream and downstream duct connections, hinge at the downstream & operating road at the upstream end.

The LOUVRED DAMPERS shall be multi blade aerofoil construction with opposed/ parallel blades of maximum 250 x 1200 mm size. The blades shall be mounted on 50 mm channel with suitable gang operated linkage and operating rod. The operation rod shall be terminated in a locking quadrant with position indicator.

The FIRE DAMPERS shall be dynamic rated against minimum static pressure of 150 mm WG & fire rated for 1½ hours (90 minutes) if installed in a 3 hour rated wall (225 brick wall) & 3 hour rated in higher rated walls. Dampers shall conform to BS476-1/CP-413 & shall be products tested and certified by an appropriate authority like CBRI. These shall be UL listed & stamped for UL 555. Dampers shall be either fusible link type or actuated through motors only. An access door shall be provided wherever necessary for accessing the damper & its mechanism. Damper open & closed positions shall be indicated. Damper shall be installed such that the fire integrity of the partition is maintained. Sleeves, if any, used for mounting the damper shall be designed for the rated fire resistance & the opening in the partition fire sealed with an appropriate and approved sealant.

 The material for fabrication of fire dampers shall be as mentioned below :

 Damper blades - 3 mm (10 SWG) Galvanised sheet steel

 Casing - 2 mm (14SWG)

 Bearing - Sintered

 Spring - SS 304

 Fusible link - Set for 70 deg C fusing temperature

All dampers larger than 1200 mm width shall be fabricated in multiple sections. The damper rods shall be MS epoxy coated with bronze bushes at one end & locking quadrant with damper position indicator at the other end. The damper rods shall extend beyond the enclosure frame and insulation wherein provided. The access doors for dampers shall be 400 x 400 mm steel bolted with rubber gasket.

**5.2.3 TECHNICAL SPECIFICATIONS OF GRILLES & DIFFUSERS**

The air outlets shall be grille or diffuser type as indicated on the drawing. The grilles & diffusers shall be aluminum powder coated as shown on the drawing & schedule of material.

Supply air grilles shall be double deflection type with horizontal face bars & vertical rear bars placed in a rigid marginal frame. Bars shall be shaped & spaced at 18 mm centres with swaged pivot pins positively holding the defections setting under all conditions of velocity & pressure. All grilles shall be provided with integral opposed blade, grille face kept operated dampers.

Return grilles shall have fixed face bars shaped and set at 18 mm centres. Bars shall be set at 5 degree deflection for vision proof installation. The grilles shall be complete with rigid marginal frames & shall be matching with the supply grilles.

Aluminum slot diffusers, grilles & diffusers wherever specified shall be of extruded aluminum with margins & GSS butterfly dampers. Grilles shall have horizontal face bars only.

Linear diffusers / grilles shall be die formed, flush mounted type with single or double directional air flow. The diffuser/grille shall be in a frame with minimum 20 mm margin. All linear air diffusing equipment shall be fitted with a distribution sheet metal plenum as shown on the drawings.

**5.2.4 TECHNICAL SPECIFICATIONS OF AIR INTAKES**

The outside air intakes shall consist of bird screen & enclosure, the total assembly fitted into wall with clear opening and the edges sealed with the sealant. The sheet metal enclosure shall be made out of 1.25 mm GI sheets flanged at both ends and with minimum 4 hold fast. The enclosure shall be minimum 250 mm long / 100mm more than the width wall or as per the site condition. The louvers shall be 100 mm wide mounted at 45 deg & spaced at 100 mm centres & shall be fabricated out of 1.25 mm GI sheets. The bird screen shall be made out of 15 x 15 mm x 1.0 mm GI wire mesh inset with 0.8 mm GI frame & bolted to the enclosure flange at 150 mm centres using 12 mm M S brass bolts & nuts.

**5.3 PIPING MATERIAL SPECIFICATIONS & RELATED VALVES**

The scope of this section comprises the supply & laying of all piping works like chilled water piping, chilled brine piping, condenser water piping, drain piping & allied works like fixing of valves and other accessories involved in this project. The chilled water piping has laid up to the AHU. The Contractor need to take necessary tapping from the chilled water pipe near AHU & connect to the AHU along with necessary valves.

The design, material construction, manufacture, inspection, testing & commissioning of water piping shall comply with all currently applicable statutes, regulations & safety codes in the locality where the equipment will be installed. Nothing in this specifications shall construed to relieve the VENDOR of his responsibility. The equipment supplied shall comply with latest applicable standards.

The contractor shall supply all piping materials like pipe, fittings, flanges (along with gasket, Galvanized MS Bolts, Galvanized nuts), pipe supports, anti corrosive treatment, paints & any other items required for the proper functioning of the system. Supports shall include all accessories like U Bolts, clamps, rods, etc & all steel structure required for proper supporting of the pipe. The contractor shall supply all necessary drains & vents as required for the safe & effective draining / venting of piping systems. It must be noted that the flow diagram / piping layouts may not indicate all drains / vents that would be required. It shall be the responsibility of the contractor to provide all required vents / drains for the proper operation of the systems. The drains shall be led up to the nearest floor drain. Manual air vents shall be installed at all high sections of piping as well as in the AHU cooling coil connection. All air vents shall have an isolating valve of equal size. The discharge from these air vents shall be piped to the nearest waste drain point. The vent size shall be as follows :

Up to ND 150 pipe Size - 15 mm size

Above ND 150 pipe size - 25 mm size

AUTOMATIC AIR VENTS

In addition to the manual air vents described above, automatic air vents of size 25 mm shall be placed at the top of the chilled water riser piping in the building.

Operation of Automatic air vent :

The float of the air vent keeps the venting valve closed. When air is collected inside the float chamber, the water level inside the vent valve decreases & the venting valve is opened. The collected air escapes through the venting valve & the water level inside the vent valve increases again, which in turn results in the closing of the venting valve. The process is a continuous one as long as air is collected in the vent valve. The air cushion in the upper part of each vent valve protects the venting valve against corrosion. When the pressure inside the system decreases below the ambient pressure for instance during draining of the system, the air vent acts as a vacuum breaker & let the air into the system.

Drain pipe with isolation valve shall be installed at the lowest point of the AHU cooling coil, at the bottom of each chilled water rise pipe & at all the other system low points. The discharge from these drain valves shall be piped to the nearest waste drain point. The drain size shall be as follows:

 Up to ND 150 pipe size - 15 mm size

 Above ND 150 pipe size - 25 mm size

**5.3.1 WELDING**

The VENDOR’s scope under this includes the following :

Welding materials like welding electrodes (Advani / Esab), gas rods, oxygen, acetylene, propane & other consumable materials and backing rings, etc as required.

Jointing material as required for all screw joints. Fasteners (bolts, nuts, stud washers, etc should be Galvanized MS ) & gaskets is required for all flanged joints. Services of erection superintendents, erection superiors, fitters, riggers, other skilled & unskilled labour. Erection tools, tackles and material, including welding machines. All fusion welding shall be done with direct current electricity using the metallic arc process with coated electrodes of a type suitable for respective kinds of material. Where the contractor desires to use alternating current shielded metal arc welding, he shall submit his procedure to purchaser for approval.

WELDING PROCESS

Unless otherwise noted, for all carbon steel piping systems the entire welding including root pass may be carried out by Manual metal arc welding only. Tungsten inert Gas welding (TIG) shall be adopted for stainless steel piping.

**PROCEDURE QUALIFICATIONS**

Surfaces to be welded shall be smooth, uniform & free from fins, tears & other defects which would adversely affect the quality of the weld. All welding faces & adjoining surfaces shall be thoroughly cleaned of rust, scale, paint, oil or grease both inside and outside up to a distance of at least 150 mm from the edge of welding groove or 12 mm from the toe of the fillet in the case of socket welded or fillet welded joints. Unless otherwise specified, joints for carbon steel pipe, 50 mm NPS & smaller shall be socket welding type as per ANSI B 16.11 and for pipes, 65 mm NPS & larger shall be of the butt-welding type as per ANSI B 16.25. All Butt welds shall be full penetration welds. For stainless steel piping all joints shall be butt welded. Stainless steel pipe lines shaving nominal wall thickness 3 mm & less shall have ends cut square or slightly chamfered. “Mirror Technique” shall be adopted for joining of HDPE pipelines. For PVC pipe lines either solvent method / hot welding or both shall be adopted. Gouging or back gouging of butt welds may be carried out where feasible by grinding, chipping, machining or other approved methods, but the surface of the cut must be cleaned to remove any carbon or oxidized metal before commencing the welding. The maximum face width of any manual arc or inert gas welding run shall be 20 mm No single run horizontal - vertical position manual metallic arc weld filled shall exceed 8 mm in size. The arc shall be struck only on those parts of parent metal where weld metal is to be deposited. No welding or welded parts shall be painted, plated, galvanized or heat until inspected and inspected and approved by the PURCHASER / ENGINEER. After deposition, each layer of weld metal shall be cleaned with a wire brush to remove all slag, scale and defects, to prepare for the proper deposition of the next layer. In case where the weld joint on pipes 100 mm NB & larger has to be radiographed as per the requirements of this specification, it is recommended that the root run be checked by liquid penetrant or magnetic particle procedures. Irrespective of the class of steel, root runs shall be made without interruption other than for changing the electrodes or to allow the welder to reposition himself. Root runs made in the shop may afterwards be allowed to cool by taking suitable precautions to ensure slow cooling. Welds made at site shall not be allowed to cool until the thickness of weld deposited exceeds tone third of final weld thickness or 10 mm, whichever is greater. Also no welding shall be done when the ambient temperature is less than 10 deg C. If the welding is unavoidable, then the CONTRACTOR shall meet the preheating requirement after discussion with site engineer. The specification and size of the electrodes voltages and amperages, thickness of beads and number of passes shall be specified in the approved welding procedure or otherwise agreed in writing. In general, coated electrodes shall be used, which will deposit weld metal having the same or higher physical properties and similar chemical composition to the members being joined. All electrodes to be used on carbon steel shall conform to ASME boiler & Pressure Vessel Codes Sec II part C or IS 814 or any other equivalent code.

**5.3.2 BALANCING VALVES**

Balancing valves shall be Cast Bronze, supplied & installed as shown on the drawings to ensure proper balancing of water flows in the hydraulic heating & cooling system. Flow measurement & balancing shall be possible with an accuracy of 4 to 7% in the normal measuring range of the valves. (When valve opening position is more than 50%) Pressure measuring nipples shall be provided for measuring differential pressure & be integral with the body & incorporate a means for shutoff when normal use. Adjustment & presetting of flows shall be made with a digital hand wheel. The setting shall be lockable with a mechanical stop to allow the valve to be closed but not opened further than to the preset value. For valves in size 10 to 50 mm the balancing valves shall offer a facility for draining of water with a separate hose connection & a stop valve. The optional draining facility shall be capable of being mounted on or removed from the balancing valve without interruption to the system operation.

 Material & pressure ratings:

1. Balancing valves with thread connections in sizes from 10 to 50 mm shall be Made in a dezincification resistant copper alloy with Brinell hardness of at least 130 & a body pressure rating of at least 20 bar (300 psi) at 150 deg C(A Metal).

b Balancing Valves with flange connection from 20 to 300 mm shall be made in cast iron for a body pressure rating at least 16 bar – 25 bar 150 deg C. Valves Sized 65 mm – 300 mm shall to be fitted with a pressure balanced cone to reduce Closing torque to allow the valve to be closed & opened easily.

c. Balancing valves shall be sized to operate in a normal measuring range of 50% to 100% of full opening to ensure maximum accuracy.

d. All balancing valves shall be manufactured in accordance IS09001.

e. To enable accurate & practical operation, measurement of flow & differential pressure shall be made with a microprocessor instrument which shall enable the operator to read the flow directly without the use of diagrams or tables.

f. The balancing of the system shall be verified in a written report, documenting valve position & water flow which shall be handed over to the consultant for approval & acceptance.

**5.3.3 TWO / THREE WAY CONTROL VALVES WITH ELECTRICAL ACTUATORS**

 Electrically operated control valves (two way, continuously modulating) for control of chilled water flow through AHU Cooling coil shall meet the requirements specified under:

 **TECHNICAL DETAILS :**

 a STYLE GLOBE

 b TYPE PLUG TYPE

 c PORT SINGLE PORT

 d TYPE MODULATING TYPE

 e CHARACTERISTIC EQUAL PERCENTAGE

 f RATING ANSI CLASS 150

 g BODY MATERIAL ASTM A 106 Gr (50 NB & BELOW)

 ASTM A 216 Gr (65 NB &

 ABOVE)

 h BONNET MATERIAL ASTM A 216 Gr WCB

 PACKING MATERIAL PTFE

 i TRIM

 STEM MATERIAL SS 316

 PLUG MATERIAL SS 316

 SEAT MATERIAL SS 316

 GUIDE MATERIAL SS 316

 j FABRICATION

 CASTING REQUIRED ANSI B 16.34

 WELDING REQ ASME

 VESSEL CODES ANSI B 16.34

 FORGING REQ ASTM A 105 / A 182

 DEFECT REMOVAL AMSI B 16.34

 k END CONNECTION FLANGED

 l ACTUATOR

 (CONTROL VALVE SHALL BE ACTUATED BY A DIRECTLY COUPLED PROPORTIONAL ELECTRICAL ACTUATOR)

 TYPE ELECTRIC

 CONTROL SIGNAL 0 – 10V DC

 HAND WHEEL REQUIRED

 TRAVEL INDICATOR REQUIRED

 MOUTING HORIZONTAL / VERTICAL

 m ACCESSORIES

 POSITION TRANSMISTTER REQUIRED

 LIMIT SWITCH W/NEMA4 ENCLOSURE REQUIRED

 JUNCTION BOX REQUIRED

NOTES:

 CONTROL VALVE SHALL BE ACTUATED BY A DIRECTLY COUPLED PROPORTIONAL ELECTRICAL ACTUATOR.

 ELECTRICAL ACTUATOR TO BE SIZED FOR SHUT OFF DIFFERENTIAL PRESSURE

 ALL TWO WAY MODULATING VALVES SHALL BE SELECTED TO HAVE A

 VALVE AUTHORITY BETWEEN 0.3 AND 0.5.

 (VALVE AUTHORITY = RATIO OF PRESSURE DROP ACROSS THE VALVE AT

 FULL FLOW TO THE PRESSURE DROP ACROSS THE AHU BRANCH CIRCUIT INCLUDING VALVE AND COOLING COIL AT FULL FLOW)

 VALVE SHALL BE SIZED TO HAVE AN OPENING OF 15% AT MIN & 85% AT

 MAX FLOW CONDITION.

 VALVES NB 50 & SMALLER: SCREWED END CONNECTION; NB 65 AND

 LARGER: FLANGED END CONNECTION

**5.3.4 BUTTERFLY VALVES**

Butterfly valves shall be of Cast Iron 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 moulded black nitrile rubber or nylon. The valves shall be suitable for a working pressure of 16.5 kg/cum and shall be complete with flow control lever and notches, factory machined companion flanges, bolts & nuts.

**5.3.5 GATE VALVES**

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

**5.3.6 BALL VALVES**

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

**5.3.7 CHECK VALVES**

Check valves shall be of Dual plate check valves with Cast Iron body, aluminum- bronze Plates, SS 316 hinge pins, springs & Buna-N seals to ANSI series 125. The check valves shall be suitable for 150 psi (10.5 Kg/sqcm) test pressure.

**5.3.8 STRAINERS**

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

**5.3.9 FLANGES & UNIONS**

Sufficient number of flanges & 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 dia 65 mm & above.

**5.3.10 PRESSURE GAUGES**

Pressure gauges shall be not less than 150 mm dia. They shall be selected for appropriate range & shall be complete with siphon & cock, etc. Pressure gauges shall be provided as shown in the drawings & as per price schedule. Pressure gauge shall be of “ALL SS TYPE”

**5.3.11 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 to 6 bar & working temperature of 120 deg C.

**5.3.12 SUCTION GUIDE**

Body Made out of Cast Iron, Cover made out of Cast Iron, Strainer stainless steel, start up filter made of fine mesh brass & Guide vanes made of CI. It should be capable of working with a operating pressure of 4-6 Bar with a operating temperature of 110 deg C.

**5.4 INSULATION**

**5.4.1 THERMAL INSULATION FOR DUCTS**

FOR SUPPLY AIR DUCTS :

Armaflex insulation with 9 mm thick sheet fixed to the duct with help of the suitable adhesive compound.

Seal all joints with 75 mm wide PVC tapes similar to Johnson & Johnson tapes. Also provide bands of tapes at 600 mm centres.

DUCTS INSIDE AHU ROOM :

Armaflex insulation with 13 mm thick sheet fixed to the duct with help of the suitable adhesive compound. Also provide bands of tapes at 600 mm centres..

**5.4.2 ACOUSTIC INSULATION FOR DUCTS / PLENUMS**

Acoustic lining with 12 mm thick rigid board fibreglass crown 300 density 48 kg / cum without aluminum foil up to a distance of 6 M from outlet of AHU. Insulation backed by 26 G perforated aluminum sheet along with RP Tissue with 3/32” dia. Holes at 3/16” staggered centres shall be mechanically attached to internal of ducts with 50mm long GI bolts, washers & nuts. Space bolts at maximum 300 mm centers and at least 75 mm from all corners. Aluminum sheets along periphery shall be minimum 50 mm in excess of the insulation and turned in to avoid the fibres entering the air stream. Unless otherwise specified, external insulation need not be applied where internal duct lining and/or acoustically lined plenums are provided.

**5.4.3 THERMAL INSULATION FOR PIPING**

Cold pipe insulation shall be done with 19 mm thick closed cell nitrile rubber insulation of Armaflex or K - Flex or equivalent brand with the help of the suitable adhesive compound. Also provide bands of tapes at 600 mm centres

**6.0 MODE OF MEASUREMENTS**

 **SCOPE :**

 The scope of this article covers the method of measurement for various items.

**A SHEET METAL WORK :**

 **DUCTING**

 Straight Duct :

 Area = Perimeter x Length

 Taper ( Transformation) Duct :

 Area = Average Perimeter x Average Length

 Bends / Elbow Pieces :

 Area = Average Perimeter x Average Length

 Dead Ends :

 Area = Cross sectional area of connected duct.

NOTE :

 No deductions shall be made for cut-outs made in ducts for providing branches, collars etc.

 Supports, flanges, vanes etc. shall have no separate measurement & shall be deemed to be included in the above.

**B INSULATION:**

 Acoustic Insulation:

 Area = Duct area (as measured under Ducting above)

 Thermal Insulation:

Mode of measurement is same as that for ducting; however the **finished** perimeter of the duct after insulation has to be considered as perimeter for the calculation.

 Under Deck / False Ceiling / Floor / Wall / Plant room insulation :

 Area = Insulated Area of the roof / false ceiling / floor / wall (as applicable)

**C REFIGERANT PIPING & ELECTRICAL CABLING :**

 These shall be measured as lump sum within the limits specified under bill of quantities.

However if average distance is specified in the bill of the quantity, the executed amount shall averaged out for all the units. No changes in pipe die’s shall be payable.

 **D GRILLES, DIFFUSERS, DAMPERS, FIRE DAMPERS :**

 Grilles & Diffusers:

 Area = Width (Excluding Flanges) x Length

 Dampers & Fire Dampers:

 Area = Cross sectional area of connected ducts (excluding flanges)

 NOTE :

 Minimum area in all the above case shall be 1 Square Feet (e.g. if area is say 0.8 SFT, it shall be payable as 1 SFT; however in case area is 1.01 SFT, the same shall be payable as 1.01 SFT)

**7.0 LIST OF APPROVED MAKES**

 AIR HANDLING UNITS NUTECH/ ZECO/ EDGETECH

 ALUMINIUM GRILLES & DIFFUSERS COSMOS / DYNACRAFT /

 AIR PRODUCTS /AIRMASTER /

 KOMALCO

 OPPOSED BLADE DAMPERS COSMOS / DYNACRAFT /

 AIR PRODUCTS / AIRMASTER / KOMALCO

 VOLUME CONTROL DAMPERS COSMOS / DYNACRAFT /

 AIR PRODUCTS / AIRMASTER / KOMALCO

 SOUND ATTENUATOR COSMOS / DYNACRAFT /

 AIR PRODUCTS / AIRMASTER

 MOTORS SEIMENS / ABB / CROMPTON

 STARTERS & CONTACTORS SEIMENS / L&T

 (DOL TYPE)

 AIR FILTERS AIRTECH / PURE AIR / THERMODYNE

 FIBREGLASS INSULATION UP TWIGA / KIMMCO

 CLOSED CELL ELOSTOMERIC ARMACELL / ARMAFLEX / K - FLEX /

 WITH ADHESIVE SUPREME

 FLEXIBLE DUCTING U P TWIGA / AUTCO / CMS

 VIBRATION ISOLATORS RESISTOFLEX / FLEXIONICS

 POWER & CONTROL CABLE POLY CAB / EQUIVALENT

 EXHAUST & FRESH AIR FANS KRUGER / SYSTEM AIR / MIACO

 G I SHEET JINDAL / UTTAM / SAIL / BHUSHAN

 G I PIPES TATA / JINDAL

 M S PIPES TATA / JINDAL

 PRESSURE GAUGE WAREE / FIBIG / H GURU

 TEMPERATURE GAUGE WAREE / FIBIG / H GURU

 BUTTERFLY VALVE ADVANCE / AUDCO / HONEYWEL /

 CASTLE

 BALANCING VALVE ADVANCE / AUDCO / HONEYWEL /

 CASTLE

 AIR VENT & AIR PURGE VALVE ANERGY

 2 / 3 WAY MODULATING VALVE BELIMO / DANFOSS / HONEYWELL /

 JCI

 BALL VALLE & Y STRAINER AUDCO / CIM / OVENTROP /

 GIACOMINI

 ELECTRICAL CABLE POLYCAB

 (COPPER ARMOURED)

**8.0 BATTERY LIMITS OF OWNER’S & SPECIAL NOTES FOR AIR CONDITIONING CONTRACTORS**

 These special notes are in addition to the terms mentioned under the commercial & technical conditions as applicable :

 a Soft / Hard refrigerant piping where ever used shall be properly installed &

 bends shall be made using tube bender

 b Where pipes &/or cables pass through walls or ceilings; proper G I Pipe

 sleeves shall be provided whether the same is specifically mentioned or not;

 no separate rates will be applicable

 c Refrigerant pipes shall be mounted on teak wood gutties to avoid physical

 contact with structure & shall be properly clamped & neatly laid; no separate rates

 will be applicable

 d Site progress register shall be maintained at site

 e All tools, tackles, instruments & manpower required for testing (including

 witness test by Engineer/ Consultant ) shall be arranged free of cost by

 contractor as & when required including for re-tests if any.

 f Free periodic services for maintenance shall be provided by the contractor

 (depending upon actual site requirement like choking of condenser coil etc.) but

 not less than ONE SERVICE PER 3 MONTH; to ensure efficient operation of the

 system.

 g The unit rates indicated shall be INCLUSIVE OF ALL MATERIAL CHARGES,

 TRANSPORTATION, LOCAL LEVIES AS APPLICABLE, LOADING,

 UNLOADING, LIFTING- SHIFTING, ERECTION, TESTING,

 COMMISSIONING,SALES TAX, WORKS CONTRACT SALES TAX, ANY

 ADDITIONAL/SPECIAL DUTIES, EXCISE, CUSTOM DUTY ETC. AS

 APPLICABLE.

 h ANY ADDITIONAL LIABILITY ARISING OUT OF A DIFFERENT INTERPRETATION OF RELEVANT ACTS SHALL BE TO CONTRACTORS ACCOUNT.

 TAXES & DUTIES INCLUDED (ITEM WISE) SHALL ALSO BE CLEARLY INDICATED BOTH AS PERCENTAGE & IN RUPEES.

 i Grouting for supports of contractors equipment shall be carried out by the

 contractor.

 j Exposing of Bars from beams & slabs for supports of ducts etc. to be

 avoided. Only anchor fasteners to be used.

 k The plant shall be handed over after satisfactory testing & after necessary

 rectifications as required; along with three sets of documents each

 comprising :

 i Detailed equipment data as approved by the HVAC consultant

 ii Manufacturer’s maintenance & operation manuals

 iii Set of AS BUILT DRAWINGS (along with ref. Pipe, cable, duct routings

 etc.) ALONG WITH REPRODUCIBLE TRACINGS OF THE SAME.

 iv Approved test readings

 v All the above documents will also be submitted in 3 sets

 vi All scaffoldings, ladders, etc. required for the execution of the work

 shall be arranged by the contractor.

 vii All working drawings of the contractor shall be submitted by AC

 consultants on paper as well as by e-mail. AC contractor shall be

 furnishing only the As-built drawing.