MECHANICAL SECTION
TENDER DOCUMENT
CLASSROOM AIR CONDITIONING MODIFICATION

Client : **Indian Institute of Tropical Meteorology, Pune.**

Project : **Multi Training Facility Building.**

Project Location : **Dr. Homi Bhaba Road, Pashan, Pune 411008.**

CONTENTS

NOTICE INVITING TENDERS

***Indian Institute of Tropical Meteorology, Pune, Maharashtra*.** *Director Indian Institute of Tropical Meteorology, Pune*. invites sealed tenders for Air conditioning work (Calssroom Modifications) For Existing **Multi Training Facility building** at Dr. Homi Bhaba Road, Pashan.Pune, Maharashtra.

This facility was commissioned in **November' 2013**. .The HVAC tender for this job is High side and low side Air Conditioning as per the specifications indicated elsewhere in the tender.

The scope of the vendor shall include selection of systems and equipments, supply, commissioning supported by appropriate documentation.

The equipment and system offered by vendor shall be user friendly for operation and maintenance

The system offered shall be highly efficient with excellent performance level, continuous trouble free operations and with minimum Ikw/TR.

1. The Tenderers are requested to give detailed sealed tender in their own forms in two bid i.e.
   Part –I Technical Bid.
   Part – II Commercial Bid

   Both the sealed bid should be sent in another sealed envelope addressed to the **Director, Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, NCL post, Pashan Pune – 411008 .INDIA** so as to reach **on or before 4 March 2014 .**

2. If a request is made to IITM, Pune for tender documents, a sum of **Rs 500.00 (Rs Five Hundred Rupees Only)** for Indigenous supplier / Indian agents (Non-refundable) has to be paid in the form of Demand Draft drawn in favour of **The Director, Indian Institute of Tropical Meteorology, Pune** enclosed in Technical Bid only.

3. You have to submit two separate bids in two separate envelopes and you may keep both the bid envelope in an envelope for sending us.

   One envelope will contain only the **TECHNICAL SPECIFICATION** of the indented equipment.

   Another envelope will contain only the financial bid in which price, maintenance, etc. and any other information, which has financial implication, will only be given.

   The main envelope will contain both the bids, should be super scribed with our tender enquiry No- **WS/HVAC/MTFB/2014 due on 04 March 2014.**

4. The technical bid will be opened on the specified due date in the presence of bidders who wish to be present & the financial bids of only those bidders will opened whose technical bid is found suitable by us.

5. The date and the time of opening of part –II (Commercial Bid) will be intimate only to pre-qualified and technically acceptable bidders for the item at a later date.

Last date and Time for receipt of Tender :-**Upto 12.30 hrs. On 04 March 2014.**

Date and Time for opening of Tenders: **At 15.00 hrs. On 04 March 2014.**

(Part-I technical Bid Only)

Pre-bid Meeting shall be conducted for Technical Clarification, **tentatively on 24 Feb 2014. On 11.30 AM At IITM, Pune.**

6.The tenders shall be submitted in the following manner and shall contain details / documents as listed here in. Technical / Commercial Bid containing the following:

1) Complete sets of the tender document as issued, dully filled and signed by the bidders, and shall comprise of:
a) A confirmation of the design conditions.
b) Bill of quantities and rates with prices.
c) Equipment catalogue / literature.
d) Separate Commercial & Technical Deviation sheet, if any.
e) Confirmation of the commercial terms

7.Bids shall be kept valid for a period of 60 days from the due date indicated above.

8.Bidders shall quote in strict accordance with the requirements of this tender. Bidders are advised to avoid making technical and commercial deviations. Bidders shall note that unless any and all deviations they may wish to make from the specifications and other terms and conditions are listed in a separate deviation sheet, it shall be deemed that the bids are in strict accordance with the requirements of this inquiry.

9.***Bidders must survey the site if they wish to, as the site is in finished condition , in consultation with CLIENT / CONSULTANT with prior appointment.***

10.The owner does not bind himself to accept the lowest or any bid or a portion there of without assigning any reason for/to split the contract during progress of work due to unsatisfactory work of any one vendor / contractor. Where more than one item is covered by this inquiry OWNER reserves the right to place orders for the various items with different bidders. OWNER also reserves the right to add or delete any item to the contract and the same shall be binding to the contractor / vendor.

11. All the rates mentioned in the tender shall be inclusive of all taxes / duties / levies / sales tax / Works contract Tax / Service Tax / Octroi duty / ESIC scheme for workers, transport charges etc.

12.This tender notice shall form a part of the contract.

13. This tender is not transferrable.

14.Conditional offer will not be considered.

15.The Director Indian Institute of Tropical Meteorology, Pune 411108 (India) reserve the right to Accept any tender in full or in part or to reject the lowest or any all tenders without assigning any reason.

16. **Rs. 20,000/- (Twenty Thousand) in form of D.D / B.G from Indian Nationalized Bank drawn in favour of**

"Director Indian Institute of Tropical Meteorology, Pune".

FOR;

Indian Institute of Tropical Meteorology,
Dr. Homi Bhaba Road, Pashan,
***Pune 411008*.**

Date: ----------

FORM OF TENDER

Following Form of Tender to be filled in by the tenderer, **on their own letterhead** and to be submitted with tender documents.

1. Works to be carried out at : ***Indian Institute of Tropical Meteorology, Dr. Homi Bhaba Road, Pashan, Pune 411008***
2. Name of the Bidder :

3. Registered Office Address :
4. Central Sales Tax Number :
   State Sales Tax Number:

5. Nature of Work : Supply, Installation, Testing & Commissioning Of the Air-conditioning and Ventilation system.

6. Total Price Offered in Rs. : Rs.

Price in words. (Rupees_____ __)

7. Validity of Quotation : 90 Days from _____**.**

8. Performance Guarantee Period: 12 Months from the date of commissioning. (Defect Liability Period) certificate.

9. Work Completion Period: by **Two Months, From date of LOI.**

10. Terms & Conditions & Scope of Work: As per Tender Document.

11. Partly Offer, Inadequate/Unclear information or any omission/deviation in the scope of work specifications, terms & conditions laid down in the tender documents make the tender liable for rejection.

I/We have carefully studied and understood all contents of this tender & aware of the scope and specifications of the work to be done and the local conditions and other factors bearing on execution of the work.

It is understood by me/us that the lowest or any tender will not necessarily be accepted.

Yours faithfully,
Place: Signature of Contractor
With Company Seal.
Date: Address:

SCOPE

1. This specification covers the manufacture, testing at manufacturers works, supply and delivery, at site, installation, testing and commissioning of Air conditioning system for a Class Room of Multi Training Facility Building at "**Indian Institute of Tropical Meteorology, Dr. Homi Bhaba Road, Pashan, Pune 411008.**"

2. It is not the intent to specify completely herein all details of construction of the equipment. However, the equipment shall conform, in all respects, to high standards, of engineering and workmanship and be capable of performing in continuous commercial operation up to Vendor's guarantee in a manner acceptable to PURCHASER who will interpret the meaning of drawings and specification and shall have the power to reject the work or material which in his judgement, are not in full accordance therewith.

BASIC GUIDELINES TO THE BIDDER

1. The contractor shall guarantee for the complete performance of the systems offered inline with the specification mentioned elsewhere in the document. It is mandatory for the bidder to carefully study the design specifications provided in this tender. Any deviation shall be highlighted while submitting the offer.

2. The drawings submitted in this tender are more or less in detail. However the necessary detail drawings including detail duct routing layout shall be submitted by the successful bidder. On completion of the job the contractor has to submit required no of copies and a CD of the as built drawings to the client.

3. The bill of material format is only for guidance and shall be filled by the bidder. The bill of material thus filled shall form the basis of offer. Any deviation proposed by bidder shall be quoted as extra items.

4. The original tender shall be returned after duly filling the ** marks.

5. The bidder shall submit their company profile and list of client along with the tender.

SPECIAL CONDITIONS OF CONTRACT

All bidders should furnish their offer in the Document issued by this office only and it should be strictly as per stipulated Tender conditions. In case of any variance Tender may be rejected at the sole discretion of the clients.

In the event of there being any change in specification / other conditions having the financial implications the extent of such financial implications will be assessed by the consultant/client and weightage in the respect of the same will be added / subtracted to the quoted amount to arrive at the final Tender amount.

All material supplied at site will be inspected by the Client's Engineers / Consulting Engineer, prior to installation or fabrication.

DESIGN DATA

1. Site Parameters

Geographical Location : Pashan Pune
10 Kms From Pune (approx), Maharashtra, India.

Altitude : 560 m above MSL

Latitude : 18.34 °N

Daily Temperature Range : 31 Deg F

1. Outside Design Conditions:

Summer	D.B.Temperature	:	104 Deg. F
	W.B. Temperature	:	76.0 Deg. F
Monsoon	D.B.Temperature	:	83 Deg.F
	W.B. Temperature	:	79 Deg.F

2. Inside Design Conditions: 24+/- 2 Deg C

The contractor shall visit and study the site on his own cost with prior permission from the client/owner. The submitted details shall guarantee the inside design conditions as specified. Any other information required by the contractor for verification shall be provided to him by the consulting engineer / the client.

CLAUSES 1 to 37

CLAUSE 1 - DEFINITIONS

1. **OWNER / PURCHASER** shall mean "M/s Indian Institute of Tropical Meteorology, Pune." on whose behalf the enquiry is issued by the **ENGINEER / CONSULTANT** and shall include his successors and assigns, as well as his authorised offices / representatives.

2. **BIDDER** shall mean the firm / party who quotes against an enquiry.

3. **VENDOR / CONTRACTOR** shall mean the successful BIDDER whose Bid has been accepted by the **OWNER / PURCHASER** and on whom the 'Contract' or Purchase Order is placed by the **OWNER / PURCHASER** and shall include his heirs, legal representatives, successors and permitted assigns.

4. **DETAIL ENGINEERING CONSULTANT** shall mean "M/s Archivista Engineering Projects Pvt. Ltd, Pune"

5. **"THE EQUIPMENT"** means machinery, equipment, materials, and other items to be supplied by the contractor pursuant to the contract.

6. **"THE WORK"** means all the duties, responsibilities and obligations to be discharged by the contractor pursuant to the contract.

7. **"THE CONTRACTORS EQUIPMENT"** means all machinery, apparatus, materials and equipments to be provided by the contractor pursuant to the contract for and in connection with the work **BUT NOT** forming or intending to form a permanent part of the plant.

8. **SUB - VENDOR / SUB - CONTRACTOR / SUB - FABRICATOR** shall mean the person named in the Contract undertaking a part of the work or any person to whom a part of the Contract has been sublet with the consent in writing of the **OWNER / PURCHASER** and shall include his heirs, legal representatives, successors and permitted assigns.

9. **MANUFACTURER** refers to a person or firm who is producer and furnisher of material or designer and fabricator of equipment's to either the **OWNER / PURCHASER** or the **VENDOR / CONTRACTOR** or both under the Contract.

10. **OTHERS** shall mean other successful **BIDDERS** whose Bids have been accepted by the **OWNER / PURCHASER** and to whom the orders have been placed by the **OWNER / PURCHASER** and shall include their heirs, legal representatives, successors and permitted assigns.

11. **INSPECTOR** shall mean the authorised representatives appointed by the **OWNER /PURCHASER** or the **ENGINEER / CONSULTANT** for purposes of inspection of materials / Equipment / Works.

12. **'Project'** shall mean the project specified in the Scope.

13. **'Site'** shall mean the actual place of the proposed 'Project' as detailed in the Specification or other place where work has to be executed under the Contract.

14. **'Month'** shall mean calendar month.

15. **Specification** shall mean collectively all the terms and stipulations contained in those portions of the Contract known as General Conditions, the specifications and such Amendments, Revisions, Deletions or Additions, as may be made in the Agreement and all written Agreements made or to be made pertaining to the method and manner of performing the work or to the quantities and qualities of the materials to be furnished under this Contract.

16. **'Bid'** shall mean the proposal / document that the **BIDDER** submits in the requested and specified form in the specification issued by the OWNER/ PURCHASER.

17. **'Plant Equipment'** and '**Work'** shall mean respectively the goods to be supplied and services to be provided by the **VENDOR / CONTRACTOR** under the Purchase order or Contract.

18. '**Contract'** or **Purchase Order'** shall mean the order and associated specifications executed by the **OWNER /PURCHASER** and the **VENDOR** including or other documents agreed between the parties or implied to form a part of the 'Contract'.

19. **Contract Price** shall mean, if there is a formal agreement the prices referred to in the agreement or if there is no formal agreement, the price agreed to be the value of the Contract.

20. Contract Period shall mean the period during which the Contract shall be executed as agreed between **VENDOR / CONTRACTOR** and **OWNER / PURCHASER** in the Contract.

21. 'Guarantee Period' shall mean the period during which the installed air-conditioning system & its 'Plant or 'Equipment' shall give the same performance as guaranteed by the **VENDOR** in the Schedule of Guarantee as in the 'Specification'.

22. 'Approved' and 'Approval' where used in the 'Specification' shall mean, respectively, approved by and approval of the **OWNER / PURCHASER** or the **ENGINEER /CONSULTANT**.

23. **CONSULTANT'S INSTRUCTIONS** shall mean any drawings and / or instructions oral and / or in writing, details, direction and explanations issued by the **ENGINEER / CONSULTANT** or the **OWNER / PURCHASER** from time to time during the 'Contract Period'.

24. '**CONTRACTOR'S** Works' or **MANUFACTURER'S** Works shall mean and include the land and other places which are used by the VENDOR / **CONTRACTOR / FABRICATOR** or **SUB - VENDOR / SUB - CONTRACTOR - SUB - FABRICATOR** for the manufacture of 'Equipment' or performing the Works.

25. 'Performance Tests' shall mean such tests as are prescribed in the 'Specification' to be done by the **VENDOR** before the plant is handed over to the **OWNER / PURCHASER.**

26. 'Virtual Completion' shall mean that all work is completed as directed and the 'Site' is cleared to the satisfaction of the **OWNER / PURCHASER** or the **ENGINEER / CONSULTANT**.

27. Words importing persons shall include Firm, Companies, Corporations and other Bodies, whether incorporated or not.

28. 'Drawings' shall mean all:

(a)Drawings furnished by the **OWNER / PURCHASER** or the **ENGINEER / CONSULTANT** as a basis for proposals.

(b) Supplementary drawings furnished by the **OWNER / PURCHASER** or The **ENGINEER / CONSULTANT** to clarify and to define in greater detail the intent of the Contract.

(c)Drawings submitted by the **VENDOR** with his proposal provided such drawings are acceptable to the **OWNER / PURCHASER** or the **ENGINEER / CONSULTANT**.

(d) Drawings furnished by the **OWNER / PURCHASER** or the **ENGINEER/CONSULTANT** to the **VENDOR** during the progress of the work, and

(e)Engineering data and drawings submitted by the **VENDOR** during the progress of the work

(f) Provided such drawings are acceptable to the **ENGINEER / CONSULTANT.**

CLAUSE 2 – CONTRACTOR`S SERVICES

a) The Contractor shall supply the Equipment and provide execute, complete and maintain the work in accordance with the Contract.

b) The Contractor shall be responsible for ensuring that the positions, levels and dimensions of the work are correct according to the Contract not withstanding that he may have been assisted by the Owner in settling out the said positions, levels and dimensions.

c) The work to be done under the Contract shall be executed with all the diligence and despatch and in the manner specified in the Contract and to the satisfaction of the Owner. The Contractor hereby undertakes that the work shall be ready for tests on completion not later than the date of completion.

CLAUSE 3 – CONTRACT PRICE

a) The owner shall pay the Contractor the sum set out in the Price Schedule hereto increased or reduced by such sums (if any) as under the Contract are to be taken into account in ascertaining the Contract Price.

b) The contractor shall credit the owner with the sum, which may become allowable or due under the contract at the times and in the manner herein specified.

c) The rates and prices quoted by the Contractor are inclusive of all taxes, duties etc. as applicable.

d) Octroi, if applicable at site, contractor shall mention it separately. Caparison will be is on landed cost at IITM

CLAUSE 4 – CONTRACTOR TO INFORM HIMSELF FULLY

The Contractor shall be deemed to have examined the site and the nature of the work and to have fully satisfied himself with regard there to prior to entering into the Contract.

CLAUSE 5 – FINANCIAL GUARANTEE FOR PERFORMANCE

(i) 10 % of the value of work done, shall be deducted from each R.A. Bill towards retention money. The Contractor shall, however, have the option of submitting Bank Guarantee for 10 % in lieu of cash retention. Bank Guarantee, if submitted, shall be valid for the full duration of defects liability period of 12 months reckoned from the date of handing over the complete works to us.

(ii) 5% performance security of the cost of award has to be submitted to the institute in the form of D.D./Bank guaranty before starting the work.

CLAUSE 6 – DRAWINGS AND DESIGNS

All technical information, furnished to the Contractor by the Owner in connection with the work and as indicated by the Owner in writing at that time to be confidential, shall be treated as confidential by the

Contractor and shall not be revealed to third parties, duplicated or used by the Contractor for any other purpose other than for this plant. This will, however, not be applicable to such information as :

Information which at the time of disclosure or thereafter become public knowledge provided that such information does not become public knowledge by reason of the Contractor's breach of the agreement.

Information which prior to disclosure hereunder was already in the Contractor's possession or in the possession of its employees then their use will be without violation of any secrecy obligation to the Owner.

Information which subsequent to disclosure hereunder is obtained by the Contractor from a third party who, to the best of the Contractor's knowledge is lawfully in possession of such information and is not subject to a secrecy obligation to the Contractor.

CLAUSE 7 – PATENTS AND OTHER RIGHTS

The Contractor shall fully indemnify the Owner against any action, claim or demand, costs of expenses arising from or incurred by reason of any infringement or alleged infringement of any letters, patent, registered design, trade mark or name copyright or other protected right in respect of the work or any arrangement system or method of using, fixing or working the Equipment authorised or recommended by the Contractor. In the event of any action being brought or any claim or demand being made against

the Owner on account of any such matters as aforesaid, the Contractor shall immediately be notified thereof and he shall at his own expenses, fully co-operate with the Owner and shall do all that, the Owner may reasonably require to assist in the defence in such action or to resist such claim or demand. The Owner shall not settle any such action or satisfy or comprise any such claim or demand without the consent in writing of the Contractor which consent will not be unreasonably withheld.

The Owner warrants on his part that any design or instruction furnished or given by him shall not be such as will cause the Contractor to infringe any letters, patent, registered, design, trade marks, or copyright in performance of the Contract.

CLAUSE 8 – ROYALTIES

All payments and royalties payable in respect of any letters, patent and other right whether payable in one sum or by installments or otherwise are included in the Contract Price and shall be paid by the Contractor as and when due to the person or persons to whom they shall be payable. The contractor shall indemnify the company from any such payments.

CLAUSE 9 – ASSIGNMENT AND SUB-LETTING OF THE CONTRACT

The Contractor shall not without the consent in writing of the Owner assign or transfer the Contract or the benefits of obligations thereof, or any part thereof, or enter into any sub-contract with any other

person, provided that this shall not effect any right of the Contractor to assign, either absolutely or by way of charges, any moneys due or to become due to him, or which may become payable to him under the Contract. Any such consent shall not relieve the Contractor from his obligations under the Contract.

CLAUSE 10 – GUARANTEES

i) All equipment supplied and work done by the Contractor pursuant to the Contract shall be guaranteed by the Contractor to be of the new & first quality and workmanship and to be of expert design conforming to generally accepted international standards and to be sufficient size and capacity and of proper materials so as to fulfil in all respect the operating and other condition specified and to meet all the requirements specified in regard thereto.

ii) If at any time during the execution of the work or during the maintenance period specified in Article 30 hereof, the Owner shall decide that any equipment supplied or work done by the Contractor fails in any respect to conform to the guarantee given by the Contractor in Article 10(i) hereof. The Owner may, as soon as, give the Contractor reasonable and practicable notice in writing / verbal of the respects in which the Equipment supplied or the work done has failed. At his own expenses, including reimbursement of all costs and expenses incurred by the Owner in connection therewith, replace any equipment and carryout any further work that may be necessary to ensure that the equipment supplied and the work done conforms to such guarantee.

iii) If the Contractor fails within a reasonable time to take such steps as may be necessary to fulfil his obligations under Article 10 (ii) hereof then the Owner may, at the expense of the Contractor take such steps as may be necessary to ensure that the equipment supplied or the work done by the Contractor shall conform to such guarantee.

iv) If any replacement of equipment or the work done by the Contractor pursuant to this Article shall be of such a nature to affect the efficiency thereof or any portion thereof, the Owner may give to the Contractor notice in writing requiring that a test or tests shall be made in which event such tests shall be carried out at the expenses of the contractor.

CLAUSE 11 – VARIATIONS AND OMISSIONS

i) The Contractor shall not alter any of the work except as directed in writing by the Owner, but the Owner shall have full power from time to time during the execution of the Contract by notice in writing to direct the Contractor to turn, to alter, amend, add to, or otherwise vary any of the work and the Contractor shall carryout such variation, and be bound by the Contract so far as applicable as though the said variation were stated in the Contract. In any case in which the Contractor has received any such direction from the Owner which either then , or in the opinion of the Contractor will later involve any increase or decrease in the Contract Price, the Contractor shall, within 7 days of such direction, advise the Owner in writing to that effect. The Owner shall thereupon approve in writing such variations which are to be given effect together with the amount of increase or decrease in the Contract Price on that account.
The Contractor shall then give effect to such variations. The difference in costs due to such variations shall be added to or deducted from the Contract Price and paid in the same way as the Contract Price.

ii) If, in the opinion of the Contractor, any such variation is likely to prevent or prejudice him from or in fulfilling any of his obligations under the Contract, he shall notify the Owner thereof, in writing and the Owner shall decide forthwith whether or not such variations shall be carried out. If the Owner amends his instructions in writing, the said obligations shall be modified to such an extent as may be agreed in writing between the Owner and the Contractor provided, however, that the Contractor may not call upon the Consultant to agree to any such variations as would, in any way, have the effect of modifying the obligations of the Contractor under the provisions of Article 7 and 10 hereof.

iii) Where the rates for extra items cannot be derived from tender rates, the same shall be arrived at on the basis of cost of materials plus cost of labour plus 10% towards Overheads and Profits of the contractor. The Contractor shall submit all details, relevant rate analysis as demanded by the Owner/Consultant to enable them to arrive at the rates to be recommended. The owner decision will be final after considering his details.

CLAUSE 12 – EXECUTION OF WORK IN INCLEMENT WEATHER

The Contractor shall during, inclement weather carry out the work in accordance with the Contract and the Contractor shall not be entitled to any additional payment over and above the Contract Price by reason of his being unable to carry out the work owing to inclement weather.

CLAUSE 13 – CONTRACTOR'S DEFAULT

If the Contractor shall fail or neglect to execute the work with all due diligence and expedition, or shall refuse or neglect to comply with any reasonable orders given to him in writing by the Owner in connection with the work, or shall contravene the provisions of the Contract, the Owner may give notice in writing to the Contractor to make good such failure, neglect or contravention. Should the Contractor fail to comply with the notice, within the time specified in the notice, then the Owner shall be at liberty

forthwith to execute such part of the works as the contractor may have failed or neglected to do all. Without prejudice to any other rights, the Owner may, under sub-contract, take the works wholly or in part thereof from the Contractor's hands and contract with any other person to complete the work or part thereof, and in that event the Owner shall have the free use of all Contractor's equipment and other things that may be at any time be on the site in connection with the work, without being responsible to the Contractor for fair wear and tear thereof, and to the exclusions of any right of the Contractor over the same. The Owner shall be entitled to retain and supply any balance which may be otherwise due, under the Contract to the Contractor or such part thereof as may be necessary to the payment of the cost of executing the said part of the work or of completing the work as the case may be and of meeting claims of third parties against the Owner and arising from or in consequence of the Contractor's failure, neglect refusal or contravention as aforesaid. If the cost of completing the work or executing a part thereof or of meeting claims of third parties as aforesaid shall exceed the balance due to the Contractor, the Contractor shall pay such excess to the Owner.

CLAUSE 14 – BANKRUPTCY AND WINDING UP

If the Contractor shall become bankrupt or insolvent, or have a receiving order made against him, or compound with his creditors, or being a corporation, commence to be wound up, not being a member's voluntary winding up for the purpose of reconstruction, or carry on its business under a receiver for the benefit of its creditors or any of them, the Owner shall be at liberty:-

a) to terminate the Contract forthwith by notice in writing to the Contractor or to the receiver or liquidator or to any person in whom the Contract may become vested, and to act in the manner provided in Article 13 hereof as though the last mentioned notice had been the notice referred to in such Article and the work had been wholly taken out of the Contractor's hands, or

b) to give such receiver, liquidator or other person the option of carrying out the Contract subject to his providing guarantee for the due and faithful performance of the Contract up to an amount to be agreed.

CLAUSE 15 – INSPECTION AND TESTING

i) Representatives of the Owner shall be entitled at all reasonable times to inspect the work or any part thereof.

ii) Whenever it is necessary to cover up any work in respect of which previous inspection is desired and the Contractor has been notified accordingly in writing, the Contractor shall give notice in writing to the Owner before the work is covered up. No such work shall be covered up or built upon unless it has been inspected and approved by the Owner or unless the Owner consents in writing to the being done without his previous inspection and approval.

iii) On receiving notice from the Contractor that the work is ready for inspection, the Owner shall without unreasonable delay, attend for the purpose of inspecting the said work.

iv) The Contractor shall uncover any part of the works or make openings for inspection as the Owner may direct and shall reinstate and make good such part to the reasonable satisfaction of the Owner.

CLAUSE 16 - ORIGIN OF MATERIALS

i) The owner shall have the right, at any time, to call upon the Contractor for evidence of origin of raw materials and parts of equipments.

ii) All goods or materials supplied or used shall be of first class quality of the grade specified.

CLAUSE 17 - MILL CERTIFICATES

All Mill Certificates covering physical and analytical tests shall be produced as called for by the owner.

CLAUSE 18 - TEST CERTIFICATES

The Contractor shall provide specified number of test certificates and/or material analysis certificates and/or radiographic examination reports as called for by the Owner.

CLAUSE 19 - ACCESS TO AND POSSESSION OF THE SITE

i) Subject to paragraph (iii) of this Article, access to and possession of the site shall be afforded to the Contractor by the Owner in reasonable time, and except in so far as, the Contractor may provide to the contrary the, Owner shall provide a road suitable for the transport of the equipment from the nearest public thoroughfare or railhead available to the site.

ii) In the execution of the work, no persons other than the Contractor's employees shall be allowed on the site, except by the written permission of the Owner, but facilities to inspect the works at all times shall be afforded to the Owner and his representatives.

iii) The access to possession of the site referred to in paragraph (i) hereof shall not be exclusive to the contractor but only such as shall enable him to execute the work. The Contractor shall offer to the Owner other Contractors and sub-contractors every reasonable facility for the execution of work concurrently with his own.

iv) Unless otherwise provided in the Contract, the owner shall give the Contractor facilities for carrying out the work on the site continuously during the normal working hours generally recognized in the district. The Owner may, after consulting with the Contractor direct that the work, shall be done at other times if it shall be practicable in the circumstances for the work to be done and the extra cost of such work (if any) shall not be added to the Contract price.

v) The Contractor shall arrange his own source of electricity and water that may be required for any testing purpose or for any other purpose at his own cost.

vi) The contractor shall construct his site office provided with furniture, telephone, fax at the space allocated within the site at his own cost.

vii) The Contractor shall make arrangements for shelters/labour colony for his workmen at his own cost. No space is available at site.

CLAUSE 20 – CONTRACTOR`S EQUIPMENT

i) The Contractor shall at his own expense, provide all equipment necessary to execute and complete the work. If any equipment is available at the site, the contractor may with the written consent of the Owner, use the same on payment of any necessary charges.

ii) All contractor's equipment shall be used solely for the purpose of the work and shall not be taken away by the contractor while it is required on the site for the purpose of the work without the permission in writing of the Owner and the contractor shall be liable for the loss of, destruction thereof or damage thereto. If there shall be due, owing or accruing to the Owner from the Contractor any money under or in respect of the Contract the Owner shall be at liberty at the cost of the Contractor to sell and dispose of any such Contractor's equipment as the Owner shall think fit, and to apply the proceeds in or towards the satisfaction of such moneys as aforesaid.

CLAUSE 21 – CONTRACTOR`S REPRESENTATIVE & WORKMEN

i) The Contractor shall employ one or more competent representatives, whose name or names shall have previously been communicated in writing to the Owner by the Contractor to superintend the carrying out of the work. The said representative shall be present on the site during working hours and orders or instructions which the owner may give to the said representative shall be deemed to have been given to the Contractor.

ii) The Owner shall be at liberty, by notice in writing to the contractor, to object to any representative or persons employed by the contractor in execution of or otherwise about the work, whose presence at site in the opinion of the Owner is not in the interest of the work or is prejudicial to the interest of the Owner, the Contractor shall remove such person from the site forthwith.

iii) The Owner shall be given the opportunity to approve the employment of casual labour hired for the work.

iv) The contractor and his employees shall abide by the site working conditions referred to in the third Schedule hereto.

v) The Contractor shall immediately notify the Owner in writing of any labour dispute affecting the work. Such notice shall describe the nature of the labour dispute and the actions to be taken by the Contractor to settle the dispute.

CLAUSE 22 – LIABILITY FOR ACCIDENTS & DAMAGE & INSURANCE

i) The Contractor shall during the execution of the work, properly cover up and protect any part of the work liable to injury by exposure to the weather and shall take every reasonable precaution against accident or injury to the work from any cause.

ii) All Contractors' equipment shall be at the sole risk of the Contractor.

iii) The Contractor shall insure all his personnel employed for the execution of the work against any personal injury that may be sustained by them as a result of the execution of the work and present satisfactory evidence that such insurance is in force. The insurance cover shall be for adequate amount prescribed by statutory Authorities.

iv) The Contractor shall at all times indemnify the Owner against all claims, damages or compensation under the provisions of Payment of Wages Act 1936, Minimum Wages Act 1948, Employees Liability Act, 1938, the Workman's Compensation Act, 1923, Industrial Dispute Act 1947 and the Maternity Benefit Act, 1961 or any modification thereof any other similar act, law and rules made there under from time to time.

v) The Contractor shall be responsible for Workman's Compensation Insurance and all other statutory requirements in regards to the personnel in the contractor's employment.

vi) The Contractor shall ensure that similar insurance policies are taken out by his sub-contractors (if any) and shall be responsible for any claims or losses to the Owner resulting from their failure to obtain adequate insurance protection in connection thereof.

vii) All formalities and legal requirements in regard to ESI coverage for the Contractor's workmen working in the plant is solely the responsibility of the Contractor including what is required for the Factory Inspectorate.

viii) Any of contractors or sub contractors persons causes damage of equipment or property of the company, the contractor will be solely held responsible for the cost of consequences thereof.

CLAUSE 23 – POSTPONEMENT OF COMPLETION DATE

i) Neither the Owner nor the contractor shall be considered in default in the performance of his obligations hereto if such performance is prevented or delayed by circumference of Force Majeure as herein defined then in such an event the concerned party shall immediately give notice in writing to the other parties of the existence of Force Majeure, together with the evidence relied upon and the postponement to the date of completion shall be mutually agreed by all the parties.

ii) For the purpose of this article Force Majeure shall mean and be limited to the following :

a) any war or hostilities

b) any riot or civil commotion

c) Any earthquake, flood, tempest, lightning or other natural physical disaster.

d) any accident, fire or explosion on the site not caused by the negligence of the Contractor.

e) any strike exceeding 10 days in duration affecting the performance of the contractual obligations hereunder.

f) any law or order of any government or government department or other authority which delay or impede the Contractor in the execution of the work.

CLAUSE 24 – PENALTY ON LATE COMPLETION

In the event of the contract work getting delayed due to reasons attributable to the Contractor, the Owner shall be levying the penalty at the rate of 1% per week to the maximum of 10% of the contract value.

CLAUSE 25 – TEST ON COMPLETION

The Contractor shall carry out tests on completion of work as specified in the Tender Document.

CLAUSE 26 – TAKING OVER

i) As soon as the work has been completed in accordance with the contract (except in minor respects that do not affect their use for the purpose for which they are intended and except for the maintenance thereof as provided in CLAUSE 29 hereof) and have passed the tests on mechanical completion, the Owner shall issue a Certificate (hereinafter called a "TAKING OVER CERTIFICATES ") in which he shall certify the date on which the work has been so completed and has passed the said tests and the Owner shall be deemed to have taken over the work on the date so certified, but the issue of a TAKING OVER CERTIFICATE shall not operate as an admission that the work has been completed in every respect. In the event of the work being divided by this contract into two or more section, the Owner shall be entitled to take over any section before the other or others and thereupon the Owner shall issue a TAKING OVER CERTIFICATE in respect thereof. If by agreement between the Owner and the Contractor any portion of the work (other than a section or sections) shall be takeover before the reminder of the work, the Owner shall issue a TAKING OVER CERTIFICATE in respect of that portion.

ii) If by reason of any default on the part of the Contractor, TAKING OVER CERTIFICATE has not been issued in respect of every portion of the work within 15 days of the date of completion, the Owner shall be at liberty to use the work or any portion thereof in respect of which a TAKING OVER CERTIFICATE has not been issued, provided that the work or the portion so used as aforesaid shall be reasonably capable of being used and the Contractor shall be afford reasonable opportunity of taking such steps as may be necessary to permit the issue of the TAKING OVER CERTIFICATE.

iii) All system shall be handed over together & taking over certificates obtained. The Job can be treated as complete only when taking over certificates for all the systems are issued.

CLAUSE 27 – SUSPENSION OF WORK

i) The Contractor shall, on the written order of the Owner, delay or suspend the progress of the work for such time or times and to such extent and in such manner as the Owner may specify.

ii) All reasonable expenses incurred by the Contractor by reason of such delay or suspension by the Owner (otherwise than in consequence of some default on the part of the Contractor) shall be added to the Contract price provided that no claim shall be made under this Article, unless the Contractor has, within a reasonable time after the event giving rise to the claim, give notice in writing to the Owner of his intention to make such claims.

CLAUSE 28 – TERMINATION

i) The Owner may, for any reason whatsoever, at any time, by notice in writing to the Contractor terminate the Contract.

ii) In the event of a termination pursuant to paragraph (i) of this CLAUSE :-

iii) The Contractor shall carry out instruction of the Owner in connection with such termination including the cancellation of orders and the termination of contracts which the Contractor may have placed with others.

iv) The Owner shall pay the Contractor for all materials used and work executed pursuant to the contract, but unpaid at the date of such termination together with any costs necessarily incurred by the Contractor in connection with the work as a result of such termination, provided that the Owner shall not be liable for any business loss or damage suffered by the Contractor as a result of such termination.

v) The Contractor shall upon receiving notice from the Owner in accordance with paragraph (i) of this Article, notify the Owner within a reasonable time of the sums for materials used and work executed as mentioned in paragraph (ii) (b) of this Article.

These sums and all terms and conditions of termination pursuant to this Article shall be agreed in writing between the Owner and the Contractor.

vi) Upon termination of the Sub-Contract pursuant to this Article, all obligations of the parties hereto shall cease except as to the liabilities of either part to the other for obligation accured to the date of such termination.

CLAUSE 29 – MAINTENANCE PERIOD

For a period of 12 months, after the work or any portion thereof has been taken over, the Contractor shall be responsible for making good with all possible speed and free of all costs and expenses to the Owner, any defects in the work arising from faulty or defective equipment, bad workmanship or from failure of the Contractor to carry out his obligations under the Contract.

CLAUSE 30 – PAYMENTS DUE FROM THE CONTRACTORS

All costs, damages or expenses for which the Contractor is liable under the Contract may be deducted from money due or becoming due to the Contractor or may be recovered by action of law or arbitration pursuant to CLAUSE 33.

CLAUSE 31 – TERMS OF PAYMENT

70% Against Supply of Material/ Equipment at site.
20% Against satisfactory Commissioning/ Demonstration.
10% Against Bank guarantee valid for 12 Month.

CLAUSE 32 – STATUTORY AND OTHER REGULATIONS

The Owner shall when requested in writing afford reasonable assistance to the Contractor in obtaining information as to the local conditions.

The Contractor shall not in the performance of the Contract in any manner endanger the safety or unlawfully interfere with the convenience of the public.

CLAUSE 33 – ARBITRATION

i) If at any time any question, dispute, or difference shall arise between the Owner and the Contractor under or in connection with the Contract either party shall as soon as reasonable practicable give to the other, notice in writing of the existence of such question, dispute or difference specifying its nature and the point at issue and the same be referred to arbitration in accordance with the provision of the Indian Arbitration Act 1940. The award of such arbitration shall be final and binding on the parties hereto.

ii) Performance of the Contract shall continue during arbitration and any subsequent proceeding.

iii) The venue of all arbitration shall be Pune.

1.2 CLAUSE 34 – RECOURSE

The Owner shall have recourse to the Contractor for any costs, claims, demand, proceedings, damages and expenses whatsoever arising out or in connection with any failure of the Contractor to perform any of his obligations under the terms of the Contract.

CLAUSE 35 – ADVERTISING

No advertising, publicity matter or other literature in relation to the Contract or the work is to be published or utilised by the Contractor except with the prior written permission of the Owner.

CLAUSE 36 – PRICES

All prices shall be fixed for the duration of the Contract and shall not be subject to escalation of any description unless stated otherwise in schedule of rates.

CLAUSE 37 – CONSTRUCTION OF THE CONTRACT

i) The Contract to the exclusions of all other agreements, statements or representation whether oral or written constitutes the full agreement between the parties hereto for the work to be performed hereunder.

ii) No variation to the terms of the Contract shall be valid unless it is made in writing and signed on behalf of both the Owner and the Contractor by their respective authorised representatives.

iii) The Contract shall be constructed in accordance with and governed by Indian Law.

iv) Where general conditions of Contract are in conflict with schedules annexed to the Contract the latter shall govern.

* **ARBITRATOR**

The Arbitrator will be the owner.

The names of the arbitrator will be selected from one of the following disciplines, in order of preference.

a) Retired High Court / Supreme Court Judges, who have experience in handling Arbitration cases.
b) Members of the Council of Arbitration.
c) Fellow of Institution of Engineers.
d) Eminent retire Chief Engineers from State / Center / P.W.D. / Public Sector undertakings.
e) As per directives of Government of India.

For the purpose of appointing the sole Arbitrator referred to above, the Appointing Authority will send within thirty days of receipt by him of the written aforesaid notice to the contractor.

The contractor shall on receipt by him of the names as aforesaid, select any one of the persons named to be appointed as a sole Arbitrator and communicate his name to the Appointing Authority within thirty days of receipt by him of the names. The Appointing Authority shall there upon without any delay appoint the said person as the sole Arbitrator. If the Contractor fails to communicate such selection as provided above within the period specified, the Appointing Authority should make the selection and appoint the selected person as the sole Arbitrator.

If the Appointing Authority fails to send to the contractor the panel of three names as aforesaid within the period specified, the contractor shall send to the Appointing Authority a panel of three names of persons who shall all the unconnected with either party. The appointing Authority shall on receipt by him of the names as aforesaid select any one of the persons named and appoint him as the sole Arbitrator. If the Appointing Authority fails to select the person and appoint him as the sole Arbitrator within 30 days of receipt by him of the panel and inform the contractor accordingly, the contractor shall be entitled to appoint one of the persons from the panel as the sole Arbitrator and communicate has name to the appointing Authority.

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

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

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

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

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

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

The award of the Arbitrator shall be final and binding on both the parties. Subject to aforesaid the provisions of the Arbitration Act 1940 or any statutory modification or re-enactment thereof and the rules made there under, and for the time being in force, shall apply to the arbitration proceeding under the clause. In all cases where the amount of the claim in dispute is Rs.75,000/- (Rupees Seventy Five Thousand Only) and above, the arbitrator shall give reasons for the award.

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

I / We hereby declare that I / We have read and understood the above terms and conditions and that we shall abide if the work is awarded to us. I / we shall achieve inside design conditions at any given time.

DATE: **SIGNATURE OF TENDERER.**

TECHNICAL SPECIFICATIONS

1.0 Scope of Work

1.0 The Scope of work covers Design, Engineering, Manufacturing/Supply, Site Fabrication Erection Testing, Commissioning, of Air-conditioning and Ventilation System at M/s. IITM, their Building at the following site.

Site Address :- Indian Institute of Tropical Meteorology,
Dr. Homi Bhaba Road, Pashan,
Pune 411008.

The following reference drawings are attached.

S.NO.	DRG.NO.	DESCRIPTION
1	T_705_FPL1_DU	HVAC layout First Floor (Modified)

The Air-conditioning equipments and installations shall conform to Indian Standards whenever applicable. The applicable Indian Standards are :

a) IS 3615 : Glossary of terms used in Refrigeration and Air-conditioning.

b) IS 325 : Three phase induction motor.

c) IS 1239 : Mild steel tubes, tubular and other wrought steel fittings.

d) IS 639 : Steel pipe flanges.

e) IS 277 : Galvanised sheet steel.

f) IS 737 : Wrought aluminum and aluminum alloy sheet and strip for general engineering purpose.

g)	IS 655	:	Metal air ducts.
h)	IS 732	:	Code of practice for electrical wiring and fittings for buildings.
i)	IS 900	:	Code of practice for installation and maintenance of induction motors.
j)	IS 1248	:	Direct acting electrical indicating instruments.
k)	IS 6392	:	Steel pipe flanges.
l)	IS 1367	:	Technical supply conditions for threaded steel fasteners.
m)	IS 3588	:	Axial flow fans electric.
n)	IS 4894	:	Centrifugal fan.
o)	IS 2074	:	Ready mixed paint.
p)	IS 2208	:	HRC cartridge fuse links upto 650 V.
q)	IS 1554	:	PVC insulated (heavy duty) electrical cables for working voltages upto and including 1100 V.
r)	IS 659	:	Air-conditioning safety code.
w)	IS 616	:	Mechanical refrigeration safety code.

Item wise Technical Specification is given here after in respective chapters.

AIR DISTRIBUTION SYSTEM

1.0 SCOPE

This specification covers the general design, materials, construction features, manufacture, shop inspection and testing at manufacturer's works, delivery at site, installation, testing, commissioning and carrying out performance test at site of Air Distribution system.

2.0 CODES and STANDARDS

The design, materials, construction features, manufacturer, inspection, testing and performance of air distribution system shall comply with all currently applicable statues, regulations, codes and standards in the locality where the system is to be installed. Nothing in this specification shall be construed to relieve the Contractor of this responsibility. In particular, the air distribution system shall conform to the latest edition of following standards.

IS 277	Galvanised Steel Sheet (Plain and corrugated).
IS 655	Metal Air Ducts.
IS 737	Wrought Aluminium and Aluminium Alloy sheet and strip for general engineering purposes.
SMACNA	HVAC Duct construction standards – Metal and Flexible.
SMACNA	HVAC Air duct leakage test manual.
SMACNA	HVAC systems – Testing, adjusting and balancing.
UL 181	Factory – Made Air ducts and connectors.
UL 555	Fire Dampers.
ASHRAE 70	Method of testing for rating the performance of Air Outlets and inlets.

3.0 MATERIAL REQUIREMENT

Ducting shall be fabricated from Galvanised steel sheet (GSS) as specified.

a. GSS duct shall be of lock forming grade, zinc coated conforming to IS 277 coating grade 180 or better.

4.0 CONTRUCTION FEATURES

Fabrication details shall be generally in accordance with the details given here under.

4.1 RECTANGULAR DUCT

a. For Low Pressure System (upto Fan external static pressure of ± 75mm WC).

LARGER SIDE OF DUCT mm	THICKNESS OF SHEET mm/G		TYPE OF TRANSVERSE JOINT	TYPE OF REINFORCEMENT
	GSS / SS	AL		
Upto 250	0.63 / 24	0.80 / 22	25x25x3mm MS angle flanged joint	--
251 to 750	0.63 / 24	0.80 / 22	25x25x3mm MS angle flanged joint	25x25x3mm MS angle @1250 mm c/c.
751 to 1000	0.80 / 22	1.00 / 20	25x25x3mm MS angle flanged joint	40x40x3mm MS angle @ 1250 mm c/c.
1001 to 1500	0.80 / 22	1.00 / 20	40x40x3mm MS angle flanged joint	40x40x3mm MS angle @ 750 to 800 mm c/c.
1501 to 2100	1.00 / 20	1.25 / 18	40x40x3mm MS angle flanged joint	50x50x6mm MS angle @ 750 to 800 mm c/c.
2101 to 2400	1.25 / 18	1.50 / 16	65x650x6mm MS angle flanged joint	65x65x6mm MS angle @ 750 to 800 mm c/c.
Greater than 2401	1.25 / 18	1.50 / 16	50x50x3mm MS angle flanged joint with tie rod(s) of 10 mm dia.	50x50x3mm MS angle @ 750 to 800 mm c/c with the rod(s) of 10mm dia, evenly spaced along reinforcing angle, spacing not exceeding 1500 mm.

b. For High pressure system duct (Fan external static pressure of +76 to +250mm WC)

LARGER SIDE OF DUCT mm	THICKNESS OF SHEET mm/G		TYPE OF TRANSVERSE JOINT	TYPE OF REINFORCEMENT
	GSS / SS	AL		
Upto 600	0.80 / 22	1.00 / 20	40x40x3mm MS angle flanged joint	40x40x3mm MS angle @ 750 to 800 mm c/c.
601 to 1200	1.00 / 20	1.25 / 18	50x50x3mm MS angle flanged joint	50x50x3mm MS angle @ 600 mm c/c
1201 to 1500	1.25 / 18	1.50 / 16	50x50x3mm MS angle flanged joint	50x50x3mm MS angle @ 600 mm c/c
1501 to 2000	1.50/16	1.80 / 14	65x65x6mm MS angle flanged joint	50x50x3mm MS angle @ 600 mm c/c
Greater than 2001	1.50 / 16	1.80 / 14	50x50x3mm MS angle flanged joint with tie rod(s) of 10 mm diameter.	50x50x3mm MS angle @ 600 mm c/c with tie rod(s) of 10mm diameter, evenly spaced along reinforcing angle, spacing not exceeding 1500 mm.

c. Longitudinal seams shall be Pittsburgh lock type at corners as shown on sheet. Longitudinal joints shall not be provided for rectangular ducting at locations other than corners, except where larger side of duct exceeds 2500mm. Longitudinal joints of ducting having side larger than 2500mm other than corner shall be grooved or standing seam as shown.

If specified, sealing of the longitudinal seams shall be accompolished using Dow corning RTV 732 Silastic or equivalent.

d. All circumferential joints shall be MS angle flanged joints.

e. Flanges used for transverse joints shall be joined with each other with Galvanised Steel (GS) bolts, washers and nuts. The bolts shall be of minimum M8 size and the spacing between bolts shall be maximum 150 mm for low pressure system and 100 mm for high pressure system.

f. For transverse angle flanged joints, neoprene gasket (3mm uncompressed thickness and width equal to flange face) adhered to the flange face shall be used. The bolt holes in gasket shall be the same as bolt diameter and shall be punched prior to insertion of gaskets.

g. All flanges shall be applied with two coats of zinc-chromate, silver or zinc paint. (Red oxide is prohibited)

h. Angles shall have welded corners and shall be riveted to the ducts at 300mm centres. (maximum).

i. For SS ducts all related appurtenances such as transverse joint angles, reinforcement angles, fasteners, turning vanes, access doors, etc. shall be of the same material as of duct.

j. Ducts shall be fabricated using lock forming machine.

4.2 ROUND DUCT

a. Round duct thickness in mm/G for GSS/SS shall be as given below:

DUCT DIAMETER mm	UPTO 50 mmWC STATIC PRESSURE POSITIVE		51 to 250mmWC STATIC PRESSURE POSITIVE		UPTO 50 mmWC STATIC PRESSURE NEGATIVE	
	SPIRAL SEAM	LONGITUDI-NAL SEAM	SPIRAL SEAM	LONGITUDI-NAL SEAM	SPIRAL SEAM	LONGITUDI-NAL SEAM
Upto 200	0.42 / 28	0.42 / 28	0.51 / 26	0.63 / 24	0.42 / 28	0.63 / 24
201 to 350	0.42 / 28	0.51 / 26	0.51 / 26	0.63 / 24	0.51 / 26	0.63 / 24
351 to 650	0.51 / 26	0.63 / 24	0.63 / 24	0.80 / 22	0.63 / 24	0.80 / 22
651 to 900	0.63 / 24	0.80 / 22	0.80 / 22	1.00 / 20	0.80 / 22	1.00 / 20
901 to 1250	0.80 / 22	1.00 / 20	1.00 / 20	1.00 / 20	1.00 / 20	1.25 / 18
1251 to 1500	1.00 / 20	1.25 / 18	1.25 / 18	1.25 / 18	1.25 / 18	1.50 / 16
1501 to 2100	1.25 / 18	1.50 / 16	1.25 / 18	1.50 / 16	1.50 / 16	1.80 / 14

b. Round duct thickness in mm/G for aluminium sheet shall be as given below:

DUCT DIAMETER mm	MAXIMUM 50 mmWC STATIC PRESSURE POSITIVE		MAXIMUM 50mmWC STATIC PRESSURE NEGATIVE	
	SPIRAL SEAM	LONGITUDINAL SEAM	SPIRAL SEAM	LONGITUDINAL SEAM
Upto 200	0.63 / 24	0.80 / 22	0.63 / 24	1.00 / 20
201 to 350	0.63 / 24	0.80 / 22	0.80 / 22	1.00 / 20
351 to 650	0.80 / 22	1.00 / 20	1.00 / 20	1.25 / 18
651 to 900	1.00 / 20	1.25 / 18	1.25 / 18	1.50 / 16
901 to 1250	1.25 / 18	1.25 / 18	1.25 / 18	1.50 / 16
1251 to 1500	1.50 / 16	1.50 / 16	--	2.25 / 12
1501 to 2100	--	2.25 / 12	--	--

c. Round duct shall have longitudinal or spiral seam, as specified Data Sheet – A. Longitudinal and spiral seam shall be as shown on sheet.

d. Angle flanges shall be used for transverse joints and shall be joined with each other with GS nuts and bolts. Angle shall be minimum 25x25x3mm for ducts size upto 250mm and minimum 40x40x3mm for ducts size greater than 350mm.

e. For transverse angle flanged joints, neoprene gasket (3mm uncompressed thickness and width equal to flange face) adhered to the flange face shall be used. The bolt holes in gasket shall be the same as bolt diameter and shall be punched prior to insertion of gaskets.

f. All flanges shall be applied with 2 coats of zinc-chromate, silver or zinc paint. (Red oxide is prohibited.)

g. For SS ducts all related appurtenances such as transverse joint angles, reinforcement angles, fasteners, turning vanes, access doors, etc. shall be of the same material as of duct.

h. Ducts shall be fabricated using lock forming machine.

4.3 DUCT SUPPORTS and HANGERS

a. Rectangular duct shall be supported from ceiling using trapeze hangers. Ducts shall rest on supporting angle or channel and this supporting angle or channel shall be supported by CS rods or angles or channels on both sides of ducts with weld or bolts.

Supporting details for low-pressure system shall be as given below.

LARGER SIDE OF DUCT mm	**SUPPORTING ANGLE mm**	**VERTICAL ROD DIAMETER mm**	**MAXIMUM SPACING BETWEEN SUPPORTS mm**
Upto 900	40x40x6	10	3000
901 to 1500	50x50x6	10	3000
1501 to 2400	50x50x6	10	2400
2401 and above	65x65x6	12	2400

Supporting details for high pressure system shall be as given below:

LARGER SIDE OF DUCT mm	**SUPPORTING ANGLE mm**	**VERTICAL ROD DIAMETER mm**	**MAXIMUM SPACING BETWEEN SUPPORTS mm**
Upto 1250	50x50x6	15	2400
1251 to 2100	65x65x6	15	2400
2101 and above	Mc 75x6	15	2400

b. Round duct shall be supported using single or two hanger straps or rods. Straps and rods shall be of GSS.

Supporting details for round duct shall be as given below.

DUCT DIAMETER mm	STRAP			ROD	
	Nos.	WIDTH mm	THICKNESS G	Nos.	DIAMETER mm
Upto 600	1	25	22	1	7
601 to 900	1	25	20	1	10
901 to 1250	2	25	20	2	10
1251 t o1500	2	25	18	2	10
1501 to 2100	2	25	16	2	10

c. Zinc coated anchor fasteners or embedded plates shall be provided for upper attachments to the building. Anchor fasteners shall be provided by Contractor. Embedded plates shall be provided by Contractor. Contractor shall provide duct supports from angle cleats welded to the embedded plates. Anchor fasteners shall be loaded to maximum 20% of the maximum rated capacity specified by the manufacturer. Site Engineer shall approve all anchor fasteners used for supporting duct.

d. In case of insulated duct, anchor fasteners shall be selected based on actual total load.

e. Duct supports shall be qualified and sized for seismic forces, if specified in Data Sheet – A.

4.4 FLEXIBLE CONNECTIONS (Metal Duct connections to Supply / Exhaust Fan)

Where sheet metal duct connects to the intake or discharge of fan units, a flexible of fire retarding double layer heavy duty canvas of at least 150 mm width shall be provided. The material shall be attached to angle frames by means of steel and over the end of the flexible connection. The material shall be secured between the band and the angle frame by bolting. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for fan intake and outlet pressures.

4.5 TRANSFORMATION

Duct transformation shall be used to change the shape of duct and shall be made for easy and noiseless flow of air. Maximum slope of transformation shall be 1:4

4.6 BENDS, OFFSETS and BRANCH CONNECTIONS

All bends, offsets and branch connections shall be made for smooth and noise less flow of air and minimum pressure drop. In case of full radius elbow optimum ratio of centreline radius of elbow to duct dimension of 1.25 shall be considered. However, due to space constraint shorter radius constraint shorter radius elbow or square elbow with guide vanes may be provided. Contractor shall furnish the details of guide vanes i.e. number of vanes,

location etc. in the drawing. The flow of air to the branch duct shall be regulated by a splitter damper or volume control damper.

4.7 SPLITTER DAMPERS and VOLUME CONTROL DAMPERS (VCDs)

a. Splitter dampers shall be fabricated of minimum 18G GSS and shall be of robust construction. The position of splitter damper shall be adjusted by use of the splitter rod.

b. VCD shall be fabricated of minimum 18G GSS and shall be of robust construction. VCD shall be single blade type for round duct and opposed blade type for rectangular duct. VCD shall have a locking device mounted outside the duct to hold the VCD in a fixed position without vibration. Fully open and fully closed position shall be marked for easier operation of VCD.

c. Motor operated VCD shall be provided, if specified. Actuator for dampers shall develop sufficient torque for easy operation of VCD.

d. VCD shall be provided with Teflon or brass bushing for blade shaft as specified in Data Sheet – A. Motor operated VCD shall be provided with Teflon bushing or sealed ball bearing for blade shaft as specified in Data Sheet – A. (Optional)

e. For SS duct, all splitter dampers and VCDs shall be fabricated from SS 304 sheet.

f. Volume control dampers shall be provided in every branch duct from individual main ducts. Volume control dampers shall also be provided in branch duct from main connecting to individual supply / exhaust air outlets, and inlets, fresh air intake duct, etc.

h. Flexible ducts

Insulated flexible ducts shall be provided to connect the supply air ducts to all air delivery devices such as grilles and diffusers. The length of the flexible duct shall not exceed 2.5 m. The airflow velocity through the flexible duct shall not be more than 3.0 m/s.

The flexible duct shall be made of triple lamination of aluminium foil, polyester and Metalised Polyester film permanently bonded to a coated spring steel wire helix. The exterior shall be wrapped with 25mm thick 32 kg / m^3 fibreglass insulation. The outer insulation jacket / vapour barrier shall be made of fibreglass reinforced Metalised Polyester film laminate. The fire rating of the flexible duct shall conform to BS 476 Parts 5, 6 and 7.

i. Very branch duct shall have test plugs.
j. Every duct tap-off from supply and return air duct shall be complete with opposed blade volume contract damper.
k. The duct leakage rate shall not exceed 1% of full flow and 25% of the ducts shall be tested at site for duct leakage.

l. CAULKING and DRAIN

Wherever duct passes through wall or slab, all the openings between masonry and duct work shall be neatly caulked or sealed by the Contractor to prevent movement of air from one space to the adjoining space. Where duct

passes through the floor, a drain trap of 100mm width across the width of the duct and 50mm depth shall be provided with a suitable plug at the lowest point in the elbow.

4.9 ACCESS DOOR

Access door shall be provided in duct before and after equipment installed in duct and at all fire damper locations. All access doors shall be fabricated of the same material as the duct work and shall have minimum two hinges. Hinges shall be zinc plated and pins shall be of brass. Access doors shall be of minimum of 305 mm x 305 mm size. At least two heavy solid brass fasteners and a brass handle are required for each door. A continuous neoprene rubber gasket shall be adhered to the opening frame with adhesive.

4.10 DIFFUSERS AND GRILLES (AIR DIFFUSION EQUIPMENT)

a. The type and quantity of diffusers and grilles shall be provided, as specified in the drawing. The contractor shall ensure that the diffusers and grilles offered are of requisite capacity, throw and terminal velocity. Diffusers and grilles shall be fabricated from CS, factory coated with rust resistant primer or extruded aluminium section with powder coating or SS 304, as specified in the drawing.

   Whenever VCD is provided with diffusers or grilles it shall be located within the duct collar. Diffusers and grilles shall be of flush pattern,.

   Ceiling diffuser shall be equipped with fixed air distribution grids, removable key operated volume control dampers and anti-smudge rings. The extruded aluminium or SS 304 diffusers shall be provided with removable central core and concealed key operation for volume control damper.

b. Linear diffusers shall be of extruded aluminium or SS 304 construction.

c. Slot diffuser shall be of extruded aluminium or SS 304 construction multi-slot type with air pattern controller provided in each slot. Supply air slot diffusers shall be provided with hit and miss VCDs in each slot.

d. Grilles with VCD shall be single acting or double acting, as specified in the drawing. Grilles without VCD shall have fixed blades or adjustable blades, as specified in the drawing.

e. All diffusers, grilles and registers shall be of extruded aluminium construction, and epoxy powder coated.

   Aluminium registers, diffusers and grilles shall be approved by Architect. The shade of epoxy powder coating for grilles, registers and diffusers shall be approved by Architect.

   All ceiling diffusers shall be of the louver face type with removable core complete with opposed blade volume control dampers. The diffuser surface shall be completely flush with the false ceiling.

   Supply registers shall be of the rectangular universal type with adjustable horizontal and vertical vanes complete with opposed blade volume control dampers. Dampers shall be adjustable by a removable key or screwdriver from the face of the registers.

   Fresh air and discharge air grilles shall be of the fixed single louver type with opposed blade volume control dampers adjustable from the face of the grilles. All diffusers, registers and grilles shall be selected to account for the noise levels as specified for various area.

For areas where square ceiling diffusers are used, they shall be of the louver face type with removable core complete with opposed blade volume control damper.

Air terminals (square diffusers) for the VAV system(wherever applicable) shall be selected to be compatible with the characteristics of the VAV box i.e., the outlet must be capable of performing at full airflow as well as reduced air flow. Linear diffusers shall be used with VAV Boxes.

Supply air register shall be of the rectangular universal type with adjustable horizontal and vertical vanes complete with opposed blade volume control dampers. Dampers shall be adjustable by a removable key or screw driver from the face of the register.

Outdoor air grilles shall be of the fixed single louver type with opposed blade volume control dampers adjustable from the face of the grilles.

4.11 PLENUMS

Plenums shall be factory fabricated of 18G GSS for low-pressure system and 16G GSS for high-pressure system. Type of reinforcement and supporting details shall be as per clause 4.1 and 4.3. Plenums shall be constructed to withstand 133% of rated plenum pressure without structural failure. Wall and roof deflection at rates pressure shall not exceed 10mm per meter of width.

5.0 INSPECTION AND TESTING

a. The ducts, branches, elbows etc. shall be inspected and the joints and connection shall be checked before these are assembled in position. After assembly the system shall be checked for tightness, vibration and noise.

b. Changes in direction shall be made with elbows with an inside radius equal to the width of the duct, where possible, but where space does not permit this radius, sharper or right – angle bends within inside radius not less than 1 of the duct width which may be used with double thickness aerofoil turning vanes. The turning vanes shall have a flange covering the whole base and they shall be riveted to the duct at not more than 75 mm intervals. Insecurely fitted turning vanes shall be rejected. All changes in dimensions and shape of ducts shall be done in a gradual manner and to approval.

c. Ductwork shall be free from waves or buckles and the sheet metal is to be machine – bent to ensure neat and accurate fabrication. If double thickness aerofoil shape internal stiffeners are fitted, the original ‘cross sectional area of duct shall be maintained.

d. Full sized standard sheets of the gauges specified are to be used and any patched or made-up pieces of duct work are liable to be rejected. Joints between flanged connections shall be fitted with neoprene rubber gaskets of 5 mm thick.

e. All duct work not insulated shall be painted externally with one coat of primer and two coats of anticorrosive paint.

f. All duct surfaces behind diffusers, registers and grilles shall be painted Matt black.

g. All toiler riser ductwork shall be of soldered or welded seams and joints throughout.

h. Duct joints and seams shall be made air tight by use of sealants acceptable to local authority. Test points shall be provide at the discharge of each air handling unit and at each individual zone of the duct work system. Test points shall consist of 25 mm diameter sockets fitted with sealing plugs which can be removed for the fitting of measuring devices. Test points shall be insulated as for the ductwork and shall be provided with identification labels.

i. Duct dimensions and drawings.
The contractor shall furnish duct layout drawings showing clear internal sizes for all air-conditioned as well as areas covered by MV.

j. Rectangular risers should be supported by angles or channels secured to the sides of the ducts with welds, bolts sheet metal screws or blind rivets. Riser support intervals should be one or two storey height.

k. In case embedded plates are provided contractor shall provide support from angle cleats welded to embedded plates.

l. Ducts shall have support on either side of elbow within two feet and for branch connection it shall be within four feet.

m. Turning Vanes

All curved elbows shall be provided with air turning vanes consists of curved metal blades or vanes arranged so as to permit the air to make abrupt turns without appreciable turbulence.

All right angle elbows shall be provided with double thickness aerofoil turning vanes extending over at least 50 percent of the while curvature of the elbow. The turning vanes shall have a flange covering the whole base be rivetted to the duct at not more than 60 mm centres.

n. Sound Attenuators (Dissipative Type) to be provided on the discharge side of all AHU fans and ventilation fans and also in return air ducts connected to AHU rooms.

o. Sound attenuators shall consist of an outer casing, sound absorbing material and internal baffles, splitters and supports. Casings shall be of galvanised steel of not less than 20 g. thickness. Casings shall be tested to 150 mm wg. and shall show no leakage, or distortion in this condition. Duct sealing compound shall be furnished by the supplier for sealing all silencers on site, where necessary, as determined by the ENGINEER.

p. Sound absorbing material shall be high-density fibreglass held in place with at least 5% compression to prevent voids due to settling. Absorption material density shall be minimum 48 kg / cu.m fibreglass faced with minimum 26 g. perforated galvanised sheet metal of minimum 40% open area. Combustion rating for the silencer acoustic infill shall not be less than the following, when tested in accordance with ASTM E84:

Flame spread classification	-	25
Smoke development rating	-	0
Fuel contribution	-	20

q. The supplier shall supply certified test data on dynamic insertion loss and self-noise with an airflow of at least 7.62 m/sec. (1500 ft / min) face velocity. Ratings shall be determined in a duct-to-reverberant room test facility, which provide for airflow through the test silencers during rating.

6.0 BALANCING

a. The air distribution system shall be tested and balanced so that the requisite temperature and air flow are maintained throughout the space to be air-conditioned or ventilated.

b. During start-up phase, Contractor shall make all arrangement for drilling or plugging of all test opening or holes, adjustment of VCDs, adjusting of fan speed to obtain specified flows, obtaining actual motor ampere readings, and all related functions to ensure the proper operation of all systems.

c. Test holes for system commissioning shall be minimum 20mm diameter to accept a standard pitot tube of 8mm diameter and each hole shall be fitted with an effective removable type seal. Location of test holes shall be decided by Contractor in consultation with Contractor / Engineer.

d. All instruments required for testing and balancing of air distribution system shall be provided by the Contractor.

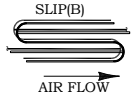
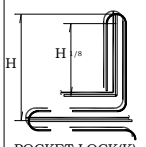
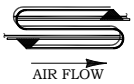
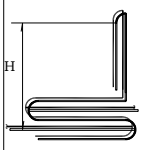
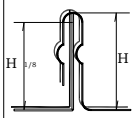
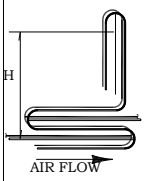
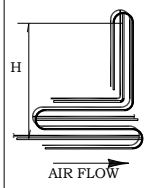
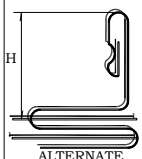
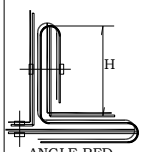
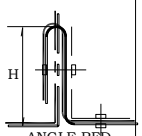
e. Complete air balance report shall be submitted for scrutiny and approval. Four copies of the approved balance report shall be provided with completion documents.

f. Splitter damper and VCD adjustments shall be permanently marked after air balancing is complete so that these can be restored to their correct position if disturbed at any time.

FIG.2-MEDIUM PRESSURE,HIGH VELOCITY RECTANGULAR DUCT CONSTRUCTION FOR STATIC PRESSURES FROM 50-150mm WG

DIMENSION OF LONGEST SIDE OF DUCT IN mm	GALVANISED IRON SHEET METAL THICKNESS IN mm	REINFORCING									
		B/W JOINTS		AT JOINTS							
		MINIMUM REINFORCING ANGLE SIZE AND MAXIMUM LONGITUDINAL SPACING		 INSIDE SLIP JOINT  DOUBLE 'S' SLIP  WELDED FLANGE	 WELDED FLANGE	 STANDING SEAM	 REINFORCED STANDING SEAM		 FLANGED JOINT	 POCKET LOCK	 COMPANION FLANGE
		WITH TIE RODS	WITHOUT TIE RODS	MINIMUM ANGLE SIZE	MINIMUM HEIGHT	MINIMUM HEIGHT	MINIMUM HEIGHT	MIN ANGLE SIZE	MINIMUM HEIGHT	MINIMUM HEIGHT	MIN. ANGSIZE
UP THRU 300		NO TIE RODS REQUIRED	NO ANGLE REQUIRED	NO ANGLE REQUIRED	16	25	25	NONE REQUIRED	25	25	30x30x3
301-460	0.71	1 TIE ROD AT 1200 INTERVAL ON CENTER LINE OF DUCT SIDE	50x50x3 AT 1200	50x50x3	22	25	25	NONE REQUIRED	25	25	30x30x3
461-610	0.86	1 TIE ROD AT 1200 INTERVAL ON CENTER LINE OF DUCT SIDE	50x50x3 AT 1200	50x50x3	35	30	30	NONE REQUIRED	30	30	30x30x3
611-900	0.86	—→	35x35x3 AT 1200	810x810x3	30 WITH TIE ROD IN CENTRE	40	40	NONE REQUIRED	40	40	30x30x3
911-1200	0.86	—→	35x35x3 AT 760	40x40x3	30 WITH TIE ROD IN CENTRE	50 OR 40 WITH TIEROD AT CENTRE	40	40x40x3	50	-	30x30x3
1201-1520	1.02	35x35x3 AT 600 WITH TIE ROD IN CENTER	50x50x3 AT 600	50x50x3	35 WITH TIE ROD IN CENTRE	40 WITH TIEROD IN CENTRE	40	50x50x3	40 WITH TIE ROD IN CENTRE	-	40x40x3
1521-1830	1.02	35x35x3 AT 600 WITH TIE ROD IN CENTER	65x65x5 AT 600	65x65x5	35 WITH 2 TIE RODS	50 WITH TIEROD IN CENTRE	40	65x65x5	40 WITH TIE ROD	-	50x50x5 OR 30x30x3 WITH TIE ROD IN CENTRE
OVER 1830	1.32	35x35x3 AT 600 WITH TIE ROD IN CENTER	65x65x5 AT 600	65x65x5	35 WITH 2 TIE RODS	50 WITH TIEROD IN CENTRE	40	65x65x5	40 WITH TIE ROD IN CENTRE	-	50x50x5 OR 30x30x3 WITH TIE ROD IN CENTRE

FIG.1-LOW PRESSURE-LOW VELOCITY SHEET METAL DUCTWORK CONSTRUCTION DETAILS

DIMENSION OF LONGEST SIDE OF DUCT IN mm	GALVANISED IRON SHEETMETAL THICKNESS IN mm	PLAIN 'S' SLIP(B)  AIR FLOW  POCKET LOCK(K)  DRIVE SLIP(A)	 AIR FLOW HEMMED 'S' SLIP(C)  BAR SLIP(E)  STANDING SEAM(I)	 AIR FLOW REINFORCED BAR SLIP(G) *	 AIR FLOW ANGLE SLIP(H)  ALTERNATE BAR SLIP(F)  ANGLE RFD POCKET(L)	 GASKET COMPANION ANGLES(M)  ANGLE RFD STANDING SEAM(J)	REINFORCING ANGLE SIZE AND MAXIMUM LONGITUDINAL SPACING BETWEEN TRANSVERSE JOINT AND/OR INTERMEDIATE REINFORCING
THRU 300	0.71	A-B K	-	-	-	-	-
301 THRU 460	0.71	A-B K	-	-	-	-	-
461 THRU 760	0.71	K	C-E	-	-	-	25x25x3 AT 1.5m cc
761 THRU 1070	0.86	K	E-C-I	-	-	-	25x25x3 AT 1.5m cc
1071 THRU 1370	0.86	K	E	G	-	-	35x35x3 AT 1.5m cc
1371 THRU 1520	1.02	K	E	G	-	-	35x35x3 AT 0.8m cc
1521 THRU 2130	1.02	-	-	G	H F L	J	35x35x3 AT 0.8m cc
2131 THRU 2440	1.32	-	-	-	H L	M J	35x35x3 AT 0.8m cc
OVER 2440	1.32	-	-	-	H L	M J	50x50x6 AT 0.8m cc

NOTES:

H : (HEIGHT DIMENSION) UPTO 1070=25
H : (HEIGHT DIMENSION) 1090 TO 2440=40
H : (HEIGHT DIMENSION) OVER 2440=50
* : ROLLED FORMED SLIP SHALL BE 400 MAXIMUM AND 50 REINFORCING ANGLE ANGLE FASTENED TO SLIP WHEN "H" DIMENSION REQUIRES 50 HEIGHT

2.0 CHECKLIST AND PERFORMANCE TEST DATA TO BE PROVIDED AFTER INSTALLATION

No	Description	O.K	Needs Attention	Not Applicable	Remarks
1.	Duct Work clean				
2.	Sealed, No leaks, Tight connection .				
3.	Fire Dampers open				
4.	Access doors closed				
5.	Lined ducts				
6.	Flexible duct connected, No Tears				
7.	System balanced				
8. a b	Short circuiting or other Air Distribution problems Note locations.				
9.	VCD provided as per specification				
10.	VCD all open and adjusted				
11.	Supply / Return / Exhaust outlets / Inlets balanced				
12.	Noticeable flow of Air				
13.	Air balance report submitted with details				
14.	VAV Box a. Minimum stops - % b. Maximum opening - %				
15.	Controls working				
16.	Thermostats				
a.	Type				
b.	Properly located				
c.	Working				
d.	Set point - °C				
e.	Space temperature - °C				
17.	Duct insulation checked				
18.	Duct supports and hangers checked including spacing				
19.	Turning valnes provided in elbows.				
20.	Test witnessed and certified				

MODE OF MEASUREMENT:

1.0 Representatives from the Contractor and Engineer shall conduct a joint inspection of the Equipments. All the discrepancies observed either incomplete works or defective work shall be clearly indicated in the joint inspection report. The mode of measurements given below is for the purpose of measurement and payment and the scope of works shall be as specified elsewhere in the specification.

1.1 Air-distribution system

1.1.1 Ducting

The following procedure for measurement shall be followed for purpose of billing in case of items subject to variation in quantities.

Payment for ducting shall be on the basis of the external surface area of the ducting.

The rate per square meter of the external surface shall include flanges, gaskets for joints, bolts and nuts, duct supports and hangers. Vibration isolation pads or suspenders; flexible connections, inspection doors, dampers, turning vanes, straightening vanes and any other item which will be required to complete the duct installation except external insulation and finish thereon.

The external area shall be calculated by measuring the over-all width and depth (including the corner joints) in the center of the duct section and over-all length of each duct section from flange face to flange face in case of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections.

In case of taper pieces average width and depth will be worked out as follows:

W1 = Width of small cross section
W2 = Width of large cross section
D1 = Depth of small cross section
D2 = Depth of large cross section

$$\text{Average Width} = \frac{W1 + W2}{2}$$

$$\text{Average Depth} = \frac{D1 + D2}{2}$$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct / sections fitted with angle iron flanges; otherwise at the bottom of the flange where the flanges are of GSS. Face to face length for taper piece shall be the mean of the lengths measured face to face from the centre of width and depth flanges.

For special pieces like bends, branches, and tees, etc, the same principal of area measurement as for linear lengths shall be adopted, except for bends and elbows, the length of which shall be the average, of the lengths of inner and outer periphery along the curvature of angle of the piece.

Duct measurements for calculation of area shall be taken before application of insulation.

1.1.2 Supply air Diffusers

Each supply air diffuser including volume control dampers, flexible ducting, adopter box and accessories as specified will be regarded as one unit for the purpose of measurement and payment. The measurements will be based on the approved drawing *I* as built drawing and paid per unit. Flexible ducting and adopter box (connecting flexible ducting and supply air diffuser) are part of supply air diffuser. The unit rate quoted for supply air diffusers shall include the cost of adopter box and flexible ducting. No separate payment will be made for flexible ducting and adopter box.

1.1.3 Return air Diffusers

Each return air diffuser and accessories as specified will be regarded as one unit for the purpose of measurement and payment. The measurements will be based on the approved drawing *I* as built drawing and paid per unit.

1.1.4 Fire Dampers

Fire dampers shall be measured by their cross-sectional area perpendicular to air flow based on the approved drawing *I* as built drawing and paid. Quoted rates shall include necessary accessories and flanges for mounting, access door etc.

1.1.5 Fusible link and solenoid for operation of Fire Dampers

Each Solenoid and associated accessories will be regarded as one unit for the purpose of measurement and payment. Each Fusible link and associated accessories will be regarded as one unit for the purpose of measurement and payment. The measurements will be based on the approved drawing *I* as built drawing and paid per unit.

1.1.6 Linear Diffusers

Linear diffusers shall be measured by linear measurements only and not by cross- sectional areas and shall exclude flanges for mounting linear diffusers. The measurements will be based on the approved drawing *I* as built drawing and paid per unit length. The supply air plenum for linear diffusers shall be measured identical to ducting as described earlier. Frame work for linear diffusers shall be included in unit rates quoted.

1.1.7 Slot Diffusers

Slot diffusers shall be measured by linear measurements only, not by cross- sectional areas and shall exclude flanges for mounting slot diffusers. The measurements will be based on the approved drawing *I* as built drawing and paid per unit length. The supply air plenum for slot diffusers shall be measured identical to ducting as described earlier. Frame work for slot diffusers shall be included in unit rates quoted.

1.1.8 Supply and return air Grilles

Supply and Return air grille area shall be calculated by measuring width by height, excluding flanges. In case of supply air grilles, volume control dampers shall form part of supply air grilles and the unit rates quoted for supply air grilles shall include the cost of volume control dampers. Frame work for grilles shall be included in unit rates quoted. The measurements will be based on the approved drawing *I* as built drawing and paid per unit area.

1.1.9 Volume control damper (VCD) in Duct

VCD (manual or motorised) shall be measured by their cross-sectional area perpendicular to air flow based on the approved drawing *I* as built drawing and paid per unit area. Quoted rates shall include necessary collars and flanges for mounting etc. No special allowance shall be payable for extension of cross-section outside the air stream. Volume control dampers in supply and exhaust fan units are part of fan units and no separate payment will be made for the same.

1.1.10 Back draft damper

Back draft damper shall be measured by their cross-sectional area perpendicular to air flow based on the approved drawing *I* as built drawing and paid per unit area. Quoted rates shall include necessary collars and flanges for mounting etc. No special allowance shall be payable for extension of cross-section outside the air stream.

1.1.11 Variable Air Volume (VAV) unit

Each Variable Air Volume (VAV) box with dampers, accessories etc, will be regarded as one unit for the purpose of measurement and payment.

1.1.12 Sound Attenuators

Each Sound attenuator with accessories will be regarded as one unit for the purpose of measurement and payment. The measurements will be based on the approved drawing *I* as built drawing and paid per unit. Sound attenuators in supply and exhaust fan units are part of fan units and no separate payment will be made for the same.

1.1.13 Flexible Connection

Flexible Connections other than at equipment inlet and outlet shall be measured by their cross-sectional area perpendicular to air flow. Quoted rates shall include necessary mounting arrangement, flanges, nuts and bolts and treated for fire requisite length of canvas cloth. The measurements will be based on the approved drawing *I* as built drawing and paid per unit area.

1.1.14 Louvers

Louvers complete with bird screen etc., shall be measured from the approved drawings / as built drawing on the basis of core area (excluding margin flanges) and paid per unit area. Louvers in supply and exhaust fan units are part of fan units and no separate payment will be made for the same.

1.1.15 Strip Heater

Strip heaters if specified including accessories will be measured from the approved drawing *I* as built drawing in KW and paid per unit KW.

END OF SECTION

INSULATION SPECIFICATIONS

1 SCOPE

This specification covers the technical requirements and essential particulars for the supply, application and finishing of the composite thermal insulation for cold equipment, piping systems, air-conditioning ducts, etc. The scope of supply of the contractor shall include, but not be limited to, the following items:

(a) Insulation material as specified
(b) Finishing material as specified
(c) Auxiliary materials such as binding and lacing wires, wire netting, bands, screws, pop-rivets, etc. as required
(d) Angles, clamps, lugs, etc. for supporting insulation
(e) Weather hoods
(f) Any material as may be required for making the insulation complete

2.0 CODES AND STANDARDS

The following are some of the codes and standards relevant to this specification:

IS 277	Galvanised Steel Sheet (Plain and Corrugated)
IS 737	Wrought Aluminium and Aluminium alloy Sheet and Strip for General Engineering Purposes
IS 8183	Bonded Mineral Wool
IS 9842	Preformed Fibrous Pipe Insulation
IS 14164	Industrial Application and finishing of Thermal Insulation Materials at Temperatures above (-) 80^0 C and up to (+) 700^0 C
BS 5970	Thermal Insulation of Pipe work and Equipment (in the Temperature Range (-) 100^0 C to (+) 870^0 C

3.0 INSULATION WORK

1) The scope of this section comprises supply and application of insulation to sheet metal ducting, , condensate drain piping, refrigerant piping, insulation for air Ductable Units.

2) Duct insulation of Closed Cell Rubber Nitrile Class O Armaflex make. The insulation shall have factory pasted wrinkled Aluminium Foil finish. (13 mm Thick) And refrigerant pipe with 9 mm thick.

3) All insulation on equipment and piping shall be applied only after the system has been pressure tested satisfactorily.

4) The consultants / owners or their authorized representatives reserve the right to peruse the weights, dimensions etc., of the insulation material supplied. Samples of all insulation material specified, in various forms shall be submitted by the successful contractor. The customers / consultants shall have the right to reject all supplies which do not conform to the specifications and to the samples so approved.

External (Thermal) insulation of air-conditioning ducts:

The entire supply air ducting for air-conditioning from AHU fan outlet to the terminal device (diffuser or grille) shall be insulated Closed Cell Rubber Nitrile Class O Armaflex make. The insulation shall have factory pasted wrinkled Aluminium Foil finish 19 mm. The thermal conductivity (K) value shall not be more than 0.033 W/m .k. at 10 deg C.

Internal (Acoustic) insulation of air-conditioning ducts :

Acoustic insulation shall be provided for the following:

(a) The first eight (5) metres of air-conditioning duct from Indoor outlet.

The portion of supply air duct which is acoustically (internal) insulated need not be insulated thermally (external).

Insulation material shall be Armaflex/ K flex open cell sound insulation.Armasound/eq.super sileance duct linear with micro ban, open cell, elastomaric nitrile rubber of 10 mm thick pasted with adhesive agent

Refrigerant Piping:

The refrigerant piping shall be carried out using specified gauge hard drawn copper tubes, with proper brazing using silver rods and duly painted as per standards for the discharge line and liquid line. The sizing of the pipe shall be inline with the manufacturers / suppliers standard. The refrigerant piping shall be properly clamped on the wall. Piping shall be tested for the 500-550 PSI .

SPECIAL CONDITIONS FOR ERECTION CONTRACT

1.0 PROGRAMME :

The Contractor shall prepare, in consultation with the Owner, a programme for the completion of the work, which may be carried by agreement in writing between the Owner and the Contractor. The contractor shall maintain progress throughout the contract period so as no to delay other traders or Contractors.

2.0 DIMENSIONS :

Dimensions are to be adhered to as stated in the specifications or as figured on the drawings. Large scale details and written particulars furnished by the Owner are to be used in preference to small scale drawings and are to be strictly followed as to their true intent and meaning. However, Contractor should check physical dimensions before proceeding with any work. Any discrepancies between drawings and physical dimensions to be brought to the notice of Owner's Site Engineer.

3.0 INCLEMENT WEATHER :

The Contractor shall take note of the climatic conditions as pertaining to the areas in which the works are located and shall be deemed to have included all costs for protecting from injury by weather all works and materials that may be so affected.

4.0 FREE ISSUE OF MATERIALS :

All items of equipment as accepted by the Contractor from any other places shall be erected by the Contractor without any damage.

5.0 SUPERVISION OF WORK :

The Owner reserves the right to interview the Contractor's nominated site representative and skilled tradesmen either prior to the award of the contract or prior to commencing work on site. Should the nominated representative not be considered suitable, the Contractor shall provide further representatives and skilled tradesmen for interview until such time as the Owner is satisfied that a competent man will

be appointed. That the Owner may have approved the appointment will in no way relive the Contractor of any responsibility under the terms of contract. All costs including travelling expenses etc., incurred by the Contractor in following the above procedure shall be born by the Contractor.

6.0 LABOUR DISPUTE :

The Contractor shall keep the Owner fully informed on all matters concerning labour disputes, strikes, etc., involving the Contractor's labour force and the effects on the progress of work. The Owner shall be kept fully informed of the course of action proposed to remove or alleviate the cause of the dispute.

7.0 COMPLETION :

7.1 Completion shall be as defined in the Time Schedule.

a. Following completion, the Contractor shall have the rights of access to all parts of the plant at all reasonable time in so far as operation of the plant by the Owner permits for the purpose of completing outstanding work and inspection and making tests and modifications to fulfill obligations under the contract. Such access shall be at the Contractor's risk. The Contractor shall not bring visitors to the plants as potential customers or for other purpose without prior agreement in writing of the Owner on each occasion.

8.0 RESPONSIBILITIES OF OWNER :

8.1 Provide an adequate area adjacent to the site to accommodate the Contractor's temporary facilities.

8.2 Provide and maintain suitable access to the job sites for the Contractor's personnel, equipment and materials.

9.0 POSSESSION OF SITE :

The Owner shall give the Contractor facilities for carrying out the works on the site from the date set for the beginning of work on the site. Access to a possession of the site shall not be exclusive to the Contractor. The Contractor shall give to any other Sub-Contractor every reasonable facility for the execution of concurrent work.

10.0 The Contractor will arrange to carry out all necessary work associated with holes for pipes though brick work, concrete or steel work and for drilling all holes for fixings.

11.0 PHOTOGRAPHS :

The Contractor shall not take photographs of any part of the works without the written permission of the Owner.

12.0 CONSUMABLES :

The Contractor shall use all the consumables but not limited to industrial gas, argon gas, oil & grease, jointing compounds, PTFE tape, emery tape, cleaning rags, saw blades, welding filter wires and electrodes etc.

13.0 CONTRACTORS CONTROL :

It is the intention of the Owner to monitor and control progress of the works and authorise interim payments. The Owner will expect the full co-operation of the Contractor in the preparation of the valuations and reporting systems and the contractor's price is inclusive of all such costs.

14.0 OTHER CONTRACTORS :

The Contractor shall take fully into account the effect of other concurrent work being carried out in the area or on the same site by other Contractors on the site will be expected from the contractors to ensure that the works are completed in a trouble free, efficient and neat manner.

ADDITIONAL CONDITIONS :-

1. Please note all required tools tackles, ladders, scaffolding etc. for execution / completion of site shall be organised by the successful contractor for carrying out their work.

2. Main incoming supply 3phase/ 1phase, 415V/230V, 50hz, will be provided by the buyer at one point. The successful contractor shall carry out further distribution between the electrical panel and equipments with necessary cabling.

3. Drain piping shall be properly laid and connected at the drain point as per specifications and as shown by the consulting engineers as per site condition.

4. The buyer shall carry out all required major civil work like opening in walls & making good of all holes. All fire seals for the openings shall be carried out by the successful contractor of F-90 Class

5. All required labour and material handling equipment required for execution at site shall be organised by the successful contractor for carrying out their work.

6. Please note all the labour engaged at site for execution of work shall be covered under ESI/PF as per the government rules, and all necessary details shall be submitted to the client before starting the execution work at site.

7. The contractor shall have a comprehensive all risk (CAR) & Workman Compensation (WC) of the full amount of the contract value.

8. For carrying out extra work or if the contractor decides to work after duty hours, special permission shall be taken from the authorities before doing so.

9. All labour employed at site shall use safety belts, safety shoes, safety gloves, safety helmet, safety goggles etc., If any of the contractor found not adhering to the safety precautions, his work at site would be stopped immediately & a penalty of Rs.1,000/- per day will be charged to him. However this delay should not reflect in the overall project delay, as it might lead to penalty as per the LD clause. Client/owner shall not be held responsible for any accidents / Mishap that may happen on site due to negligence / overlook of safety precautions.

10. **Tenders received through Fax / Email / Telegraphic / Telex will not be considered.**

11. The tenders must be clearly written or typed without any cancellations/ Corrections or Over writing.

    a) Tenders, which are submitted without following the Two-Bid offer system, will summarily be rejected.

    b)Unsigned Tender Will also be rejected.

    c)Part and incomplete tender are liable to be rejected.

d) Commercial bid should be submitted in the Soft Copy in the CD.

15. The technical bid should accompany with complete specification, Manufacture's name address and relevant Technical Literature /Brochures with warranty terms.

16. **Delivery Period** – As the time is the essence of the contract, delivery period mentioned in the work order should be strictly adhered.

17. Kindly attached a of copy of your latest DGS & D, New Delhi registration certificate under the compulsory scheme of Ministry of Finance regarding the registration of Indian Agent of foreign supplier wherever it is applicable.

A. The tenderer is required to furnish the Permanent Account Number (PAN) Allotted by the Income tax Department. If registered with the National Small Industries Corporation, the registration number, purpose of registration and the validity period of registration etc. Should also be provided in the Technical bid for Indian Agents.

B. A copy of latest Income tax Clearance Certificate from Income tax Department (INDIA) for Indian Agents.

18. Tender must clearly indicate the feature offered unit price, VAT , transport ,transit insurance, installation Charges. Institute cannot furnish any concessional certificate for exemption of reduction in VAT or other duty/tax. The vendor should mentioned the price of the equipment and the duties / taxes to be paid such as customs duty /excise duty /VAT taxes etc separately.

19. The prices quoted should be firm and irrevocable and not subject to any change whatsoever, even due to increase in cost of raw material component and fluctuation in the foreign exchange rates and excise duty.

20. **WARRANTY/GUANRANTEE**:- The equipment is to be guaranteed for trouble free performance for a minimum period of **ONE YEAR** after installation. Supplier shall finally warrant that all the stores, equipment and component and component supplied under the ORDER shall be new and of the first quality according to the specification and shall be free from the defects.(even concealed fault, deficiency in the design material and workmanship). The defects, if any , during the guarantee period are to be rectified free of charge by arranging free replacement wherever necessary. Further. the technical specification and requirements may also be verified and quoted accordingly.

21. Please mentioned that during warranty period who will maintain system/equipment. Indicate the name of the firm, address, contact person, phone no. And tax no. Etc. In your technical bid.

22. After successful installation what will be the minimum down time of equipment/instrument in case of breakdown. If the identified firm or person fails to put the system into working condition what is the futher alternative course of action suggested by you to adhere to minimum down time.

23.Warranty period will stand extended for a period of total down time of the equipment.

24.After warranty period (post warranty) who will maintain system indicate the name of firm, address, contact person, phone no. etc. in the your technical bid.

25.No sub-contracting will be allowed for installation or maintaining system..during of after warranty period.

26.Discount offered should be mentioned clearly in the commercial bid.

27.A) The earnest Monet deposit of Rs 20,000/- **(Rs Twenty thousand Only)** must be paid / sent along with your technical bid in the form of a Demand draft. Banker's cheque or Bank guarantee (preferably from a nationalised Bank only) drawn in the favour of **The Director, Indian Institute of Tropical Meteorology, Pune**., Otherwise your technical & financial bids will not be considered at all. The Earnest Money of successful bidder will be return only after installation, commissioning, and satisfactory demonstration and on acceptance of the system by user engineer as per the terms of our work order. If any the successful bidder fails to fulfil the contractual obligation before the due date, he will forfeit the EMD.

B) The Earnest money of Unsuccessful bidder whose technical bid ha not been found suitable will be return within 15 days after receipt of Technical Committee recommendations.

C) Though EMD has to be submitted by Demand Draft, Banker's Cheque or Bank Guarantee, we prefer to have Bank Guarantee for easy return to the bidder once a decision is taken by IITM.(Specimen of bank Guarantee is enclosed at Annexure 'A'

D) Tenderers not accomplished with Demand Draft / bank Guarantee towards "Earnest Money Deposit" will summarily be rejected.

28.Please indicate pages nos on your quotation eg. If the quotation is containing 25 pages, please indicate as 1/25, 2/25, 3/25 ------25/25.

29. **Firms which have already supplied similar equipment to IITM and have not completed required installation /Commissioning / after sales service / warranty replacement etc. Such firms offers will not considered for further evaluation and no enquiries thereafter will be entertained.**

30. **In the event the manufacture / Supplier proposes for the amalgamation, acquisition or sale of its business to any firm during the contract period, the Buyer/Successor of the Principle Company are liable for execution of the contarct and also fulfilment of the contractual obligation i.e. supply installation, commissioning ,warranty, maintenance /replacement of spares accessories etc. With the same cost / ordered value while submitting your bid, you may confirm this condition.**

31. Conditional offer will not be considered.

32. All dispute are subject to exclusive jurisdiction of Competent Court and Forum in Pune , India only.

33. The Director, Indian Institute Of Tropical Meteorology , Pune 411008 , India reserves the right to accepts any tender in full or Part or to reject the lowest or any or all tenders without assigning any reason.

34. **Corrupt Or Fraudulent Practice :-**

A) IITM requires that the Bidder /Suppliers / Contractors under this tender ,observed the highest standard of ethics during the procurement and execution of such contract. In purpose of this policy, IITM
I. Defines for the purpose of this provision, the terms set forth as follows:

a) "Corrupt practice" means the offering, giving, receiving or soliciting of anything of the value to influence the action of the public official in the procurement process or in contract execution; and

b) "fraudulent practice" means a misrepresentation of facts in the order to influence a procurement process or execution of a contract to the detriment of IITM, and includes collusive practice among bidder (prior to or after bid submission) designed to establish bid price at artificial non-competitive level and to deprive IITM of the benefits of the free and open competition;

II.Will reject a proposal for award if it determines that bidder recommended for award has engaged in corrupt of fraudulent practice in competing for the contact in question;

B)IITM will declare a firm ineligible, either indefinitely or for stated period of time, to be awarded a Contract if it at any time determines that the firm has engaged in a corrupt and fraudulent practice in Competing, Or in execution, a contract.

STATUTORY OBLIGATIONS

The Contractor shall observe that the working as intended in the document is adhered to or conforming to and NOT NECESSARILY BE LIMITED to the following standard regulations :

i) FACTORIES ACT as amended (latest)

ii) Explosive Act.

iii) Safety regulations laid down by Central Government and state Authorities and the Owner.

iv) Indian Electricity Rules and Regulations.

v) Standard Codes for Pressure Piping (ASA B31.3.1973)

vi) Statutory requirements for inspection and test of all lifting appliances and auxiliary lifting gear.

vii) Labour Act.

viii) Local-By-Laws.

ix) Regulations laid by the Fire Safety Committee, Insurance Association of India.

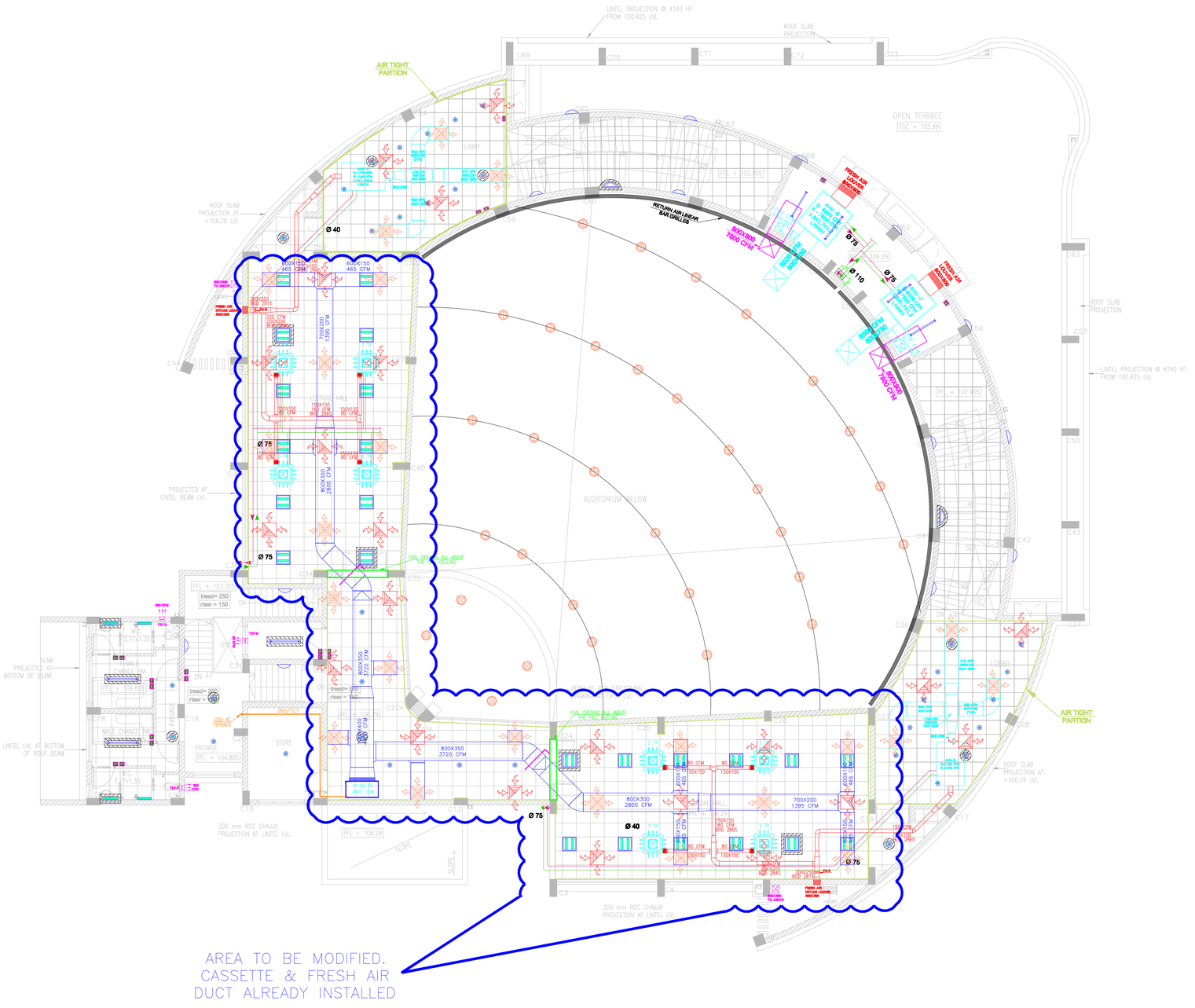
1.2 In case of conflict between these specifications and the standards which come into force shall be considered as included and applicable to the work covered here and elsewhere in this documents.

LIST OF APPROVED MAKE:

Sr.No.	Component	Approved Make
1	Insulation (Thermal/Acoustic)	
	A. – Fibreglass	Up Twiga / Khimco / Owens / Eqv.
	B. - Nitrie Rubber	Armaflex /Armacell
2	Grilles / Diffusers/Damper	Cosmos / Caryaire (Ravistar) / Air Products / Air cosns air/ Treat Air
3	Ducting Sheet	TATA / Jindal /Uttam
4	Ducting	Nutech / Alfa / Radiant/Eq.
5	Pipe Supports	Energia / Intellotec./Amtech
6	PVC Drain Pipe	Filolex/Reliance
7	Split AC	Daikin/LG/Carrier/Toshiba/Panasonic
8	Power Cable	Polycab / Finolex/KEI
9	Control Cable	Polycab / Finolex / KEI
10	Electrical Components	Siemens / Schneider
11	Screw	Nettlefold / Gkw / Eqv.
12	Copper Piping	Mhandev
13	Flexible Duct	UP-Twiga

---------- END OF SECTION ----------

Provision of Additional HVAC System For Lecture Halls for Indian Institute Of Tropical Meteorology at Pashan, Pune.							
Sl.No	**Description of Work. PART "A"**	**Unit**	**Qty**			**Total**	
				Supply Rate (Rs.)	**Total Supply Amount (Rs.)**	**Labour Rate (Rs.)**	**Total Labour Amount (Rs.)**
1	The system should be with necessary IDU's & ODU's.Out Door Unit shall be complete with Inverter type compressor only, microprocessor . The system should be with necessary combinations of IDU's & ODU's along with necessary interconnecting Cabling, Refrigerant charge, Drain pumps in all IDU's etc.						
1.1	SITC of Ductable Units of following configuration, with corded remote,canvas connection, MS stand, Treated rod of suffucient size,						
1.1.1	11.0 TR @ 2400 CFM	Nos	1		0		0
1.1.2	16.0 TR @ 3200 CFM	Nos	R.O.				
1.2	Supply and laying of 22 G soft Refrigerant Pipes with 9 mm thick nitrile rubber insulation over sutcion and liquid line. Outdoor insulation shall be cladded with suitable mtl. to prevent it from exposed weather ,Cable trays for running refrigerent pipes, control cable. pressure testing, nitrogen flushing						
1.2.1	5/8 And 11/8	Rmt	35		0		0
1.3	SITC PVC sheathed control copper cables including end termination for various equipment through walls/ceiling over cable trays & fixing arrangement, Glands complete in all respect	Rmt.	35		0		0
1.4	SITC of GI Ducting Factory Fabricated with Duct Mate Flanges as per SMACNA with insulation of Rubber Nitrile with pre clad AL Armaflex / K-Flex make.inclussive of supports 8 mm GI Threaded rod and C channel (40x40x2.55 mm thk). The RTV sealent shall be considered. Refer technical specification for more details. The thickness of the insulation shall be 13 mm for supply as well for return air. The thermal insulation shall be closed cell rubber nitril with factory pasted AL foil.						
1.4.1	18 guage	SQM	R.O.				
1.4.2	20 guage	SQM	R.O.				
1.4.3	22 guage	SQM	115		0		0
1.4.4	24 guage	SQM	85		0		0
1.5	Duct Acoustical insulation for Supply air ducting with Armaflex/ K flex open cell sound insulation.Armasound super sileance duct linear with micro ban, open cell, elastomaric nitrile rubber of 10 mm thick."	SQM	45		0		0
1.6	Extruded Aluminium powder coated box type supply air dampers opposed blade construction	SQM	5		0		0
1.7	Aluminium Powder Coated Linear Grilles with VCD (Volume Control Damper)	SQM	R.O.				
1.8	Hard UPVC drain piping (2 mm thick) with 32 mm heatlon insulation & finished with PVC tape. Plumbing grade pipe only clamped properly.						
1.8.1	25 NB	RMT	R.O.				
1.8.2	32 NB	RMT	35		0		0
1.8.3	50 NB	RMT	R.O.				
1.8.4	80 NB	RMT	R.O.				
1.9	Supply & installation of motorised damper,with piano switch & electrical cabeling.(800 X 300 mm) Complet in all respect.	Nos	2		0		0
1.10	Preinsulated flexible duct with end clamps as required in various sizes as below. The duct shall fire retardant UL standard approved.						
1.10.1	100 - mm Dia	Rmt.	R.O.				
1.10.2	125 - mm Dia	Rmt.	R.O.				
1.10.3	300 - mm Dia	Rmt.	R.O.				
1.10.4	450 - mm Dia	Rmt.	50		0		0
1.11	Removing of existing armstrong 600 X 600 mm grid false ceiling of class room to install the duct and diffuser Reinsttaltion of the same shall be done after succesfull fixing of HVAC duct ,diffuser and indoor unit insttalation. Any damage tile shall be replace by new one of same make and Quality. including wall opening and finishing for return air path. Scrap shall be manage as per client location. All civil related work and rework shall be done by succesfull bidder only. (Request to site visit for more understanding).	Sq.m	280		0		0
					0		0
	GRAND TOTAL				0		
	NOTE- Cost Shall be landed cost at IITM, including all taxes and Transportation						



DRG.NO :-

T_705_FPL1_DU

SHEET 1 OF 1

DUCTING NOTES :

1. The drawing shows general arrangement and location of the equipment, duct work, piping etc. The contractor shall be responsible for coordinating the mechanical installation with the structure, electrical and other services and shall provide additional offsets and fittings as necessary.
2. Duct dimensions on drawings are clear inside dimensions.
3. Sheets used for fabrication shall be free from any corrosion.
4. Duct work shall be constructed from hot dip galvanized sheet steel to BS:2989 Grade Z.
5. The thickness of the sheet shall be in accordance with duct size as per SMACNA/DW-142.
6. The duct work shall be supported from main structure using angle iron supports and threaded rods. Supports shall be adequate to take the load without deforming the duct. Support system as per site condition
7. All steel work for supports shall be painted with approved anti corrosive paint.
8. The insulation of duct work shall be done after testing.
9. All duct work for supply air, return air, fresh air shall be insulated with Nitrile rubber of closed cell 19 mm thick ,Class "O"
10. The grilles/diffusers shall be selected to maintain noise level less than 35 db.
11. All diffusers/grilles shall be extruded aluminum finished with polyester powder coating. Door grills shall be non vision type.
12. The volume control dampers shall be provided where ever required for balancing air flow. The balancing shall achieve flow rates within +/-10 % of specified value.

LEGEND

SR NO.	SYMBOL	DESCRIPTION
1		MOTORIZED DAMPER
		SUPPLY AIR DUCT
3		SUPPLY AIR DIFFUSER
4		RETURN AIR DIFFUSER
5		RETURN AIR DIFFUSER

REV	DRWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	ALTERATION
06				
05				
04				
03				
02				
01				
00	YOGESH 08.10.13	RAKESH 08.10.13	SUMANT 08.10.13	ISSUED FOR TENDER.

REFERENCE DRAWING

DRAWING TITLE	HVAC LAYOUT FOR FIRST FLOOR PLAN.
PROJECT	MULTI FACILITY TRAINING BUILDING
CLIENT	I.I.T.M PUNE

REV.	DATE	STATUS
R0	08.10.13	ISSUED FOR TENDER.

ARCHIVISTA
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DRG. NO:- T_705_FPL1_DU | SCALE- 1:100 (A1) | DATE :- 25/06/2011

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