Dr. Babasaheb Ambedkar Open University

Name of Work : `Air-conditioning work for **Dr. Babasaheb Ambedkar Open University, Ahmedabad**."

TECHNICAL BID

ISSUED TO : _____

_____

_____

_____

CLIENT :

Dr. Babasaheb Ambedkar Open University
Jyotirmay Parisar, Dr. Babasaheb Ambedkar Open University Marg, Sarkhej-Gandhinagar Highway, Chharodi, Ahmedabad, Gujarat 382481

ARCHITECT :

Hiren A. Gandhi & Associates,
`Kanuj' 2 Municipal Housing Society
B/h. St. Xavier's Loyola Hall
Memnagar, Ahmedabad.

MAY 2018

CONTENTS

PROJECT INFORMATION
Dr. Babasaheb Ambedkar Open University

TENDERED WORK: Air-conditioning work for **Dr. Babasaheb Ambedkar Open University, Ahmedabad**

SITE ADDRESS:

Dr. Babasaheb Ambedkar Open University
Jyotirmay Parisar, Dr. Babasaheb Ambedkar Open University Marg,
Sarkhej-Gandhinagar Highway, Chharodi
Ahmedabad, Gujarat 382481

ARCHITECT & PROJECT CONSULTANTS Hiren A. Gandhi & Associates
Kanuj, 2, Municipal Staff Housing Society, Behind St. Xaviers Loyola High Scool, Memnagar, Ahmedabad, Gujarat 380052

DR. BABASAHEB AMBEDKAR OPEN UNIVERSITY

Tender Notice

PROJECT: HVAC work for Library, Director room,
Board room, Faculty room & Class room etc. at
Dr. Babasaheb Ambedkar Open University Campus, Ahmedabad.

The Registrar, Dr. Babasaheb Ambedkar Open University invites bids with two bid system for the providing of Expansion Work -detailed in the table below from the bidders having experience for similar type of works, registered in R&B / State Government / Central Government in appropriate class and meeting the qualifying criteria specified.`b

Sr. No.	Name of work	Estimated cost in Rs.	Bid Security (EMD) (Rs.)	Tender fee (Rs.)	Period of Completion
1	2	3	4	5	6
1	HVAC WORK FOR LIBRARY, DIRECTOR ROOM, BOARD ROOM, FACULTY ROOM & CLASS ROOM ETC. **AT DR. BABASAHEB AMBEDKAR OPEN UNIVERSITY**	83,53,950 .00/-	83,500.00/-	3,000.00 (Non refundable)	3 months

	Milestone Dates for Tendering	
1.	Tender Downloading Date	From 06/06/2018 to 27/06/2018
2.	Tender Online submission	On or Before 17:00 Hrs., 27/06/2018
3.	Submission of tender in physical form , Dr. BabaSaheb Ambedkar University, S.G. Highway, Ahmedabad.	On or Before17:00 Hrs., 29/06/2018
4.	Pre bid meeting to be held in university campus	Date and time for prebid meeting on-13:00 Hrs., 19/06/2018.
5.	Opening of Technical Bid	On 15.00 Hrs., 03/07/2018
6.	Opening of Financial Bid	Will be intimated to the bidders at the time of opening of technical bid
7.	Bid Validity	90 Days from last date of submission of the bid

INSTRUCTIONS TO TENDERERS

1. Before tendering, the tenderer shall visit the site and also carefully examine the conditions intender document, the specifications, drawings and schedule of quantities. If there should be or appear to be any ambiguity in or discrepancy between any of these documents or between figured and measured dimensions upon the drawings, he should immediately refer the matter to the Engineer In-Charge.

2. Any clarifications required on the tender documents/drawings may be obtained from the office of the Architect/Client.

3. The tenderer shall ascertain the location, size and condition of the areas available for his use as working areas and all other information affecting his tender.

4. The tender shall be made on the basis of the rates in the priced schedule of quantities being firm and not subject to adjustments for any reasons whatsoever, unless expressly indicated otherwise in these documents.

5. The employer will not be responsible for or pay for any expenses which may be incurred or losses to person or property suffered by any tenderer in connection with visits to and examination of the site and in preparation of the tender.

6. Tenderer must use only the forms issued by the Engineer In-Charge to fill in the rates:

a) The tender form must be filled in English and all the entries must be made by hand and written in ink. If any of the documents is missing, or unsigned, the tender may be considered invalid by the employer at his discretion. All pages shall be initialed. All signatures on the tender document shall be dated. All the pages of all the sections of the tender document shall be initialed at the lower left hand corner or signed wherever required in the tender papers by the Tenderer or by a person holding a Power of Attorney, authorizing him to sign on behalf of the Tenderer before submission of the tender.

b) The tenderer shall clearly and legibly, write both in words and in figures, in English, in ink the unit rates and amounts as tendered by him. The same as that specified in words against that same item. In case and they differ, the lower of the two given values shall be considered the correct tendered value. The hand written values shall be such that they do not lead to any Mis-interpretation.

c) Corrections: all corrections and alterations if any, in the entries of the tender document will be signed in full by the Tenderer with the date. No erasures or over-writing shall be permitted. Failure to comply with these conditions may render the tender void at the employer's option. No advice of any change in rate or conditions after the opening of the tender will be entertained.

d) Signature of Tenderer: The tender shall contain the name, residential address, address of the place of business of the person or persons submitting the tender and shall be signed by the Tenderer with his usual signature along with the seal of the company in token of his/their having acquainted himself/themselves with the General Conditions of Contract, Specifications, Special Conditions, etc. as laid down. Any tender with any of the documents not so signed will be rejected. A partnership firm shall furnish with the tender, the full names and addresses of all the partners. It should be signed in the name of the partnership company’s name by all the partners or by a duly authorized representative, followed by the name and designation of the persons signing. A copy of statement filed with the Registrar of Firms evincing the constitution of the firm with the names of all

the partners shall be furnished. A tender submitted by a Corporation shall be signed by an authorized representative, with a power of Attorney and which shall accompany the tender.

e) If a Tenderer signs at tender in a language other than in English, the total amount tendered shall, in addition, be written in the same language as that of the signature.

f) Tender must be submitted in original and without making any additions or alternations and as per details given hereunder.

g) The rates shall be filled in the schedule given with this tender document. Reservations of any kind regarding the tender conditions and schedule of rates shall not be permitted. Tenders with reservations or deviations from the tender conditions given in the tender document, are liable to be rejected.

h) Addenda/corrigenda to this tender document, if issued, must be signed and submitted along with the revision of quantities the Tenderer shall write clearly the revised quantities in the schedule of rates of the tender document and shall price the work based on the revised quantities when amendments for quantities are issued in addenda.

i) The tenders, as submitted, shall consist of the following:

The tender should be submitted in two envelopes as described hereafter. Both envelopes shall be super-scribed as in para (b) above and each envelope should also bear the envelope number prominently.

Envelope No. 1 (Technical Bid) shall contain :

Complete set of original tender documents (Technical Bid), as issued, together with any addenda/corrigenda, as stated above.

- Copies of the latest audited Balance Sheet, GST Registration Certificate, Turnover certificate,
- last three years Balance sheet and Profit & Loss ac. must be attached with CA certificate
- All data & details stipulated in Tender and PQ with proofs.
- Earnest Money Deposit – Rs. 80,000/-
- Original physical copy of authorization letter from the manufacturer: dated after tender date, stating the project name- “AIR CONDITIONING WORK AT DR. BABASAHEB ABMBEDKAR OPEN UNIVERSITY”
- Contractor should have completed at least 1 job, Minimum value of works of Rs. 67,50,000/- in a single contract for HVAC work (VRV/VRF system) in last 3 year of time.

- Or Contractor should have completed at least 2 jobs Minimum value of works of
- Rs 45,00,000/- in a single contract for HVAC work (VRV/VRF system) in last 3 year of time.
- Tenderers letter, in duplicate, giving technical of financial clarifications if any.

- Set of tender drawings if supplied to the tenderer.

It should be importantly noted that the contents of envelope No. 1 must not reveal rates of any items of the total tender amount quoted by the tenderer.

Envelope No. 2 (Price Bid) shall contain :

Sealed envelop No. 2 shall contain the bound tender volumes duly filled in, priced and singed as specified.

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7. The Employer does not bind himself to accept the lowest or any tender, and reserves to himself the right to accept or reject any or all the tenders, either in whole or in part, with out assigning any reasons for doing so.

8. Tenders will be considered only from recognized, bona fide Contractors in the trade concerned. Each tenderer shall submit with his tender a list of large works of a like nature they have executed giving details as to their magnitude and cost, the proportion of work done by the Contractor in it and the time within which the work was completed.

9. **Mode of Submission of Tender:**

a) Tenders should be addressed to **Dr. Babasaheb Ambedkar Open University,** Jyotirmay Parisar, Opp. Shri Balaji Temple, Sarkhej-Gandhinagar Highway, Chharodi, Ahmedabad, Gujarat 382481. and submitted at the same address.

b) Kind Attn: Mr.
Original Tender plus one signed photocopy, shall be placed in a sealed cover which shall be Superscripted: *TENDER FOR AIR-CONDTIONING WORK FOR* **Dr. Babasaheb Ambedkar Open University** *office at* Jyotirmay Parisar, Opp. Shri Balaji Temple, Sarkhej-Gandhinagar Highway, Chharodi, Ahmedabad, Gujarat 382481.

c) No tender will be received after the time and date indicated in the letter of invitation to tenderer, under any circumstances, whatsoever.

10. Transfer of tender document purchased by one intending Tenderer to another is not permissible.

11. **Validity:**
The tenders submitted by the Tenderers shall remain valid for acceptance for a period of **3 Months** from the date of opening of the tender. The Tenderers shall not be entitled during the said validity period, without the consent in writing of the Client to revoke or cancel his tender or to vary the tender given or any term thereof.

12. **Cost of Preparing Tender:**

- The employer shall not be responsible for, nor shall reimburse any expense or loss which may be incurred by any Tenderer in the preparation of the tender.

- The schedule of Quantities shall be examined by the Tenderer prior to the signing of the Contract to check that the total cost of each item is calculated correctly at the rates quoted. Should any error(s) be found, the rate shall remain unaltered but the total cost of the item shall be corrected as required.

- All the expenses incurred in preparation of the Articles of Agreement or Contract with the successful tenderer, inclusive of the cost of the Stamp Paper involved, shall be borne by the successful tenderer.

13. **Information to be obtained by the Tenderer:**

The tenderer in fixing his rates shall for all purposes be deemed to have himself independently obtain all necessary information for the purpose of preparing his tender. Any error in description or quantity or omission therefrom shall not vitiate the Contract or release the Contractor from executing the work comprised in the Contract according to the drawings and the Specifications at the scheduled rates. He is deemed to know the scope, nature and magnitude of the works and the requirements of material and labor and the type of work involved, etc.

The Contractor shall be deemed to have visited the site & the surroundings, to have satisfied himself to the nature of all existing structures, if any, and also as to the nature and the conditions of the railways, roads, bridges and culverts, means of transport and communications, whether by land, water or air and as to possible interruptions thereto and the access and egress from the site, to have made inquiries, examined and satisfied himself as to the sites, for obtaining all necessary materials, equipment, tools, tackles, available accommodation whenever required, depots and such other buildings as may be necessary for executing and completing the works, to have made local & independent inquiries as to the prevailing climatic conditions and all other similar matters affecting these works. The Contractor is deemed to have aquatinted himself as to his liability for payment of octroi, government taxes, customs duty and other charges. Any neglect or failure on the part of the Contractor in obtaining necessary and reliable information upon the foregoing or any other matters affecting the Contract shall not relieve the Contractor from any risks or liabilities or the entire responsibility from completion of the works at the scheduled rates and time in strict accordance with the Contract Documents.

14. **Date of Commencement and Stipulated Date of Completion:**
The date of commencement shall be taken as the date on the letter of intent issued to the Contractor to start the work. The stipulated date of completion shall be as specified in the Memorandum. If the Contractor fails to complete the work within the period, he shall pay Penalty/Liquidated Damages to the Client as stipulated in the Memorandum.

15. **Tender Drawings:**
Drawings listed in Bases of Design & Description of HVAC System are intended to give the Tenderer an idea of the type of work involved. These drawings are only indicative and for use prior to tendering only. Work shall proceed at the site only on the basis of Working Drawings which shall be prepared by the Contractor after the award of the contract.

16. **Sufficiency of Quantities:**
The quantities furnished in the Schedule of Quantities are approximate, based on preliminary design and are meant primarily to form a common basis for the tender. Actual quantities may vary from the quantities given in the schedule. Quantity variations of all variable items shall be payable at the unit rates forming part of the Contract. However, no extra claim whatsoever shall be entertained from the Contractor on this account for items intended as Lot, Job or on As Required basis.

FORM OF TENDER

Date:

To,
Dr. Babasaheb Ambedkar Open University
Jyotirmay Parisar, Opp. Shri Balaji Temple,
Sarkhej-Gandhinagar Highway, Chharodi
Ahmedabad, Gujarat 382481

Dear Sir,

Having examined the Tender drawings, specifications, designs and schedule of quantities relating to the works specified in the Memorandum hereinafter set out and having examined the site of the works specified in the said memorandum and having acquired the requisite information relating thereto as affecting the tender, I/we hereby offer to execute the works specified in the said memorandum within the time specified in the said memorandum at the rates & total amount mentioned in the attached priced schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in General & Special Instructions, General & Special Terms & Conditions, Schedule of Quantities and with such materials as are provided for, by and in all other respects in accordance with such conditions so far as they may be applicable. We have carried out independent assessment of the project's HVAC requirement and performed HVAC calculations. We confirm that the HVAC System/equipment offered by us shall achieve and maintain the specified conditions in each A/C Area under all load conditions.

We are aware that HVAC System, equipment and materials have to comply with the requirements of LEED and ECBC for Green Building Certification. We will provide assistance in documentation and furnish the data/details of the equipment to the Green Building Consultant and also carry out measurements of various parameters and commissioning process for the fulfillment of Green Building certification. Quoted Rates are inclusive of the same.

MEMORANDUM

1. Name of the work: Air-conditioning work for Dr. Babasaheb Ambedkar Open University, Ahmedabad Library Building

2. Location of the Site: Jyotirmay Parisar, Opp. Shri Balaji Temple, Sarkhej-Gandhinagar Highway, Chharodi, Ahmedabad, Gujarat 382481

3. Completion Time: 3 Months from the date of issue of Letter of Intent to the successful tenderer (including successful Testing & Commissioning by Contractor, and Taking Over by Client).

4. Defects Liability/ Guarantee Period: 12 months from the date of Taking Over of the System by the Client after successful Testing &Commissioning by Contractor, and Taking Over by Client; and

submission of Documents by the Contractor as stipulated in the section *Data/Documents To Be Furnished By Bidders*.

Initial Security Deposit - 5% of the total tendered amount

Retention money- 5% retention money to be kept from every running bill - to be released with final bill payment.

Scope of Guarantee shall be as described in General Terms & Conditions.

5. Period of honoring Payment Certificates: 15 (fifteen) working days after issue of certificate by the Engineer In-Charge.

6. Minimum value of work for Running Bills/ Interim Certificates: Rs 10,00,000.

7. Terms of Payment : FOR DIRECT-ORDER & IMPORTED ITEMS

- 20% Advance
- 80% against pro-rata delivery

:FOR INSTALLATION, LOW SIDE WORK & MISC ITEMS

- 10% Advance, within 10 days of acceptance

of Order by the successful Tenderer

- 5% Against approval of all working drawings
- 60% Against delivery of items, on pro-rata

basis (i.e. 60% of the unit rate of each item against delivery of that item); provided all working drawings have been submitted by the Contractor(NOTE: Pro-rata payment for supply of ducting would be made against formed, ready-to-install ducts and not against the supply of GI sheets)

- 10% Against completion of erection of HVAC system in all respects
- 15% Against successful testing &commissioning of the HVAC system; taking over of the same by the Client; submission of documents by the Contractor as listed in Data To Be Furnished By Bidders; and submission of a Performance Bank Guarantee from a nationalized Bank for the like amount, valid till the Guarantee Period. The Bank Guarantee shall cover all liabilities mentioned in General Terms &Conditions.

11. Validity Period of Tender: 2 Months from the last date for submission of Tenders should this tender be accepted, I/We hereby agree to abide by and fulfill the terms and provision of the conditions of Contract so far as they may be applicable. I/We enclose evidence of my/our experience of execution of works of similar nature and magnitude carried out by me/us and also GST Registration Certificates.

Yours faithfully,
[TENDERER]
Signature and addresses of Witnesses:

I. II.

HVAC TERMS AND CONDITIONS

1. Intent of these specifications is to define the requirements for design, supply, installation, testing & commissioning of HVAC System. The entire work shall be carried out in accordance with these terms and conditions and generally as per the scope drawings set forth in the documents. The liability of the contractor shall not be limited to the scope of work mentioned, but shall also extend to achievement of the inside conditions as per the BASES OF DESIGN, as well as complete, safe and satisfactory operation of the system as approved by the Engineer In-Charge/client. Any alternations/additions, equipment, apparatus, instruments, material and labour required in order to achieve the completeness of the HVAC system as above shall be deemed to be included in the scope of the contractor without any extra cost to the client, whether the same have been covered or not in the specifications and drawings. However, any changes required in design and installation shall be brought to the notice of the Engineer In-Charge; and due approval shall be obtained therefor.

2. Scope of Work:
The scope of work covered under this tender includes design, supply, installation, testing &commissioning of the HVAC system for the application mentioned, and shall be generally as per the schedule of quantities and scope/tender drawings.

3. Tender Drawings:
The tender drawings, which are enclosed herewith, shall serve as scope drawings. They indicate the general scheme of the HVAC system requirement. However, actual location, distance, levels, etc. will be governed by actual field conditions. The contractor shall check architectural, structural, water supply, drainage, false ceiling, lighting and other services plans to avoid possible installation conflicts. Should drastic changes from original plan be necessary to resolve such conflicts, the contractor shall notify the Engineer In-Charge and secure written approval before the installation is started. Discrepancies in different plans or between plans and actual field conditions or between plans and specifications shall be promptly brought to attention of the Engineer In-Charge for a decision.

4. Codes & Regulations:
The installation shall be in conformity with bye-laws and regulations of local authorities concerned in so far as these become applicable to the installation. The installation shall also be in conformity with the relevant codes of the Bureau of Indian Standards and ASHRAE standards . Wherever a reference of Standard specification is made in this document, it should imply the latest revision of that standard, including such revisions/amendments as may be issued by the issuing authority, during the course of the work contract. Compliance with all the applicable laws/rules pertaining to

materials and workers/personnel shall be the liability of contractor. In case the drawings and/or specifications require something which violates the bye-laws and regulations then the bye-laws and the regulations shall govern the requirement of this installation and the fact shall be brought to the notice of the Engineer In-Charge.

5. Materials & Workmanship:
The materials used by the contractor shall be new, free from defects and of the best quality and workmanship and shall be in conformity with the latest and best Engineering practice.

The entire installation work shall comply with the applicable standard specifications of:
(a) The Bureau of Indian Standards
(b) The Air Conditioning and Refrigeration Institute of America (ARI)
(c) American Society of Heating, Refrigerating & Air Conditioning Engineers (ASHRAE)

6. The contractor shall employ a qualified Erection Engineer at site who shall be assisted by adequate number of skilled and experienced staff.

7. Any material supplied by the contractor, if damaged in any way during cartage or execution of work or otherwise, shall be made good by the contractor at his own cost.

8. Accompaniment to Tender:
The tenderer will attach to the tender, at the time of submission, a statement containing information on the following points on a separate proforma:

(a) The contractor should check all the drawings attached with the tender document, for the areas made available for installing his equipment and machines for proper and efficient functioning of his equipment. Any changes required to be made in the building and/or structure should be clearly brought out in a separate letter to be submitted along with the tender document.

(b) Absence of specific comments on this issue by the Bidder along with quotation will be deemed as acceptance of the spaces available for HVAC equipment, supply &return air paths, etc.

(c) Details of works carried-out and on-hand, their magnitude, names of the owners and the architects/Engineer In-Charges.

(d) Applicable rates for all-in-all maintenance charges for similar system for one, three and five years.

9. Tender Rate:
Rate shall be quoted for the total work (on works contract basis) including design, supply, installation, testing commissioning and validation of the System. The rate quoted by the tenderer shall include charges for bringing in, transport, hoisting, installing, loading and unloading at and from the works and site. The rate shall be inclusive of all taxes, costs, levies, duties, octroi, service tax, GST and any other duties, levied by the Government or local authorities. The rate shall also be inclusive of scaffolding, hire of tools and plants, drilling and chiseling holes, grooves/trenches in walls, concrete, masonry etc., and making them good.

10. Firmness of Prices:
The quoted price i.e. the Contract Sum and all unit rates shall remain firm during the entire execution period till the entire work is complete in all respects.

11. Conditions by Contractor:

Any conditions submitted by the contractor in his offer not complying with the conditions mentioned in this Document shall be regarded invalid unless otherwise agreed by the Engineer In-Charge/client in writing.

12. Working Drawings:

On award of the work, the contractor shall submit to the Engineer In-Charge detailed Working Drawings (as per reference list given at the end of this section) covering all items of equipment and installation. Shop/working drawings shall show detailed dimensions of all equipment, exact position of air/water intakes, outlets & exhaust, space requirements for access, repair and maintenance for equipment, frame details, support details, foundation drawings etc. The shop/working drawings shall also contain details of other services that are required for installation/completeness of HVAC system, cutouts, openings, framework, foundations etc.- whether covered under HVAC scope or not. Soft copy and minimum 2 sets of hard copies (paper copies) of all drawings shall be submitted to Engineer In-Charge for approval/comments. After technical approval, soft copy and necessary sets of hard copies shall be submitted for Engineer In-Charge, Client, PMC& Architect for their record, approval& coordination.

13. Approval of Drawings:

No fabrication and installation should be put into execution until the working drawings are approved by the Engineer In-Charge. The contractor shall initially submit in duplicate the drawings prepared by him for checking and verification by the Engineer In-Charge. The contractor shall submit adequate copies of final drawings as required by Engineer In-Charge/client on approval. While it will be attempted to accord the technical approval of the contractor's shop/working drawings on an expeditious basis, it will be the responsibility of the contractor to secure from the other related agencies like the Architect, Interior Designer, etc. their approval for the scheme of installation as far as the building & interior layouts, aesthetics, etc. are concerned. Approval of the drawing by the Engineer In-Charge shall in no way relieve the contractor from the responsibility of providing a complete and satisfactory installation and achieving &maintaining the stipulated design conditions. Any errors, omissions and shortfalls shall be rectified, and made good free of cost to the client regardless of the fact that the installation may in the first place have been carried out as per the approved drawings.

14. Schedule of Quantities:

(a) The quantities of ducting, insulation, piping, cabling, etc. mentioned in the tender documents are tentative and are given for tenderer's guidance and to have uniform basis for tendering. The contractors should quote unit rates for variation in quantities.

(b) The accompanied tender drawings show the route of ducts, pipes, cutouts provided in slabs, beams, etc. and the equipment layout. Should there be any ambiguity in plans and specifications or obstructions, the same should be brought to the notice of the Engineer In-Charge while submitting the tender documents.

(c) The contractor should carry out detailed calculations for estimating the quantities of variable quantity items on approval of drawings. Any increase or reduction in the quantities of variable items shall be payable or deducted at the unit rate for that particular item. Any extra item not covered under the schedule of quantities but needed for the completion of the work shall be first approved by the Engineer In-Charge/client. The contractor shall submit a quotation for such items before he commences work or purchases material in connection with such item(s). The quotation shall show the rate analysis, namely the break-up of material, labour, profit, overheads, etc. In case the estimated quantity exceeds the quantity mentioned in Schedule of Quantities by over 5%, written approval from the client and the Engineer In-Charge should be obtained before delivering the item/s, failing which, no claim for increase in final Contract Value may be entertained on this account.

15. Supervision:
The work shall have to be carried out in best workman like manner and supervised by competent full-time erection engineers having adequate experience in the similar kind of work.

16. Insurance & Indemnification:
The contractor shall take adequate insurance cover for his equipment, material, installation and personnel for transport/storage and till the completion of the project; and indemnify the Client against any claims or liabilities that may arise due to any cause whatsoever. The insurance shall cover, but not be limited to, accidents, injuries, third party liabilities, workmen compensation, loss, theft, etc. of items, properties and human beings.

17. During progress of the work, completed portions of the building may be occupied and put to use by the owner but the contractor will remain fully responsible for maintenance of HVAC installations till the entire work covered under his contract is satisfactorily completed by him and taken over by the owner.

18. Clean Up At the Work Site and Over-Night Stay at Site:
It is contractor's responsibility to keep the site clean during the execution, installation, and after the execution of work, from debris, rubbish and wastage of any material used by him. No over night stays of contractor's persons/workers shall be allowed at the work site.

19. Testing:

(a) All equipment and space conditions shall be tested to establish equipment ratings
(b) and indoor space conditions. The test results shall be furnished to the Engineer In-Charge as per the tender. Instruments required for testing shall be furnished by the contractor.

(b) After testing and commissioning, all equipment shall be painted in an approved manner.

(c) All equipment shall be guaranteed for the specified ratings with +/- 3% tolerance.

(d) After all the tests and adjustments have been made, the plant shall be put to run test as per frequency & duration specified by the Engineer In-Charge.

20. Training:
The contractor shall provide free training at site in operation and maintenance of the System supplied by them to the client. The duration of training shall be till the time client is completely conversant with the operation and maintenance of the System.

21. Mode of Measurements:

(a) GI/Al Ducting: Duct surface area to be worked out geometrically from the physical measurements for straight lengths as well as for taper pieces, bends, fittings, etc. Finished exterior surfaces of ducts shall be measured and paid for. Vanes, splitters, wastage, etc. shall not be included while taking ducting measurements.

(b) Duct Insulation: Thickness of the insulation plus the respective duct dimensions will be considered for area calculations. The area shall be worked out geometrically; and no additions shall be made for bends, tapers, curves, fittings, etc.

(c) Piping (bare/insulated), cabling, earthing, etc.: Physical measurements and geometrically worked out quantities shall be considered without any additions for bends, reducers, fittings, valves, strainers, etc.

(d) Quantity of grilles, diffusers & dampers shall be taken as per respective collar or duct size. Effect of any “minimum measurements” charged by grille supplier to HVAC contractor for smaller sizes shall be included in HVAC Contractor’s unit rates and not in measurements.

22. Submission by the Contractor on completion:
The contractor shall submit two complete sets of *As Built* drawings & documents to the Engineer-in-charge after completion of the work. These drawings & documents must give following information:

(a) Testing & Validation Results.

(b) Ducting, air distribution, piping, cabling, HVAC plant room & AHU room/s.

(c) Air distribution system & AHU rooms layouts.

(d) Schematic diagram of various controls used in HVAC System.

(e) Schematic drawing of electrical work including ferrule diagram

(f) Schematic & route drawings for piping installation.

(g) Detailed operating instructions

(h) Detailed maintenance schedule for smooth running of the HVAC System.

(i) List of spare-parts required to maintain the System for two years of operation.

23. Guarantee/Defects Liability:
The contractor shall guarantee the installation for a period of 12 months from the date of Taking Over by the client, and submission of stipulated documents, regardless of the date of supply/erection of any equipment. Guarantee shall cover all components of the HVAC system, irrespective of the nature of item, any consumable items like refrigerant gas, oil, etc. if the loss of the same is due to reasons attributed to contractor. Any damage or defect that may arise or lie discovered or in any way be connected with the equipment or fittings supplied by him or in the workmanship shall be rectified or replaced by the contractor at his own expenses as deemed necessary by the Engineer-in-charge.
The achievement and maintaining of prescribed design conditions as per Bases of Design, throughout the Guarantee period shall also be the responsibility of the contractor. It is to be clearly understood that the specifications, drawings, schedule of quantities and computed design, refrigeration, air conditioning and heating loads given under Bases of Design of this specification is only for the tenderer's guidance. The tenderer shall carry out comprehensive load calculation and provide alternative/additional equipment as required to achieve the specified inside conditions. Complete set of architectural drawings are available at the office of the architect and reference may be made to these drawings as required for load calculations. Contractor shall also provide routine preventive maintenance to the system/plant for the trouble free operation of the system, and remove any faults that may arise during the guarantee period without any cost to the client.

24. Compensation against Capacity Shortfall:
The HVAC plant capacity shall be tested as per Tender Specifications. Where test results indicate measured capacity to be less than specified/contracted capacity, the Contractor shall pay compensation to the owner @2% of the Contract Sum for every 1% shortfall in capacity.
No compensation shall, however, be payable if the measured capacity is within +/-3% of the specified capacity. If the capacity shortfall is over 10% the owner shall have the right to reject the entire system at the risk and cost of contractor. All instruments required to carry out tests shall be

furnished by the Contractor at no extra cost. If the capacity is found to be higher than the required, the contractor shall have to set it right to the specified capacity without any extra cost. Equipment shall be tested as per the relevant ASHRAE/other code specified by the Engineer In-Charge.

25. Guaranteed power consumption and related Penalty:
Guaranteed power consumption for the entire HVAC System including all its components is to be indicated by the Bidders. Power consumption in excess of the indicated value shall be penalized as per the formula to be decided by the Engineer In-Charge/client.

26. Stipulated Completion Time:
The entire work including design, manufacture, supply, installation, testing and commissioning is to be completed within the completion time mentioned in the MEMORANDUM of this Tender Enquiry, viz. 3 Months.

HVAC SPECIAL CONDITIONS

The following clauses shall be considered as an extension of, and not as a limitation of, the obligation of the Contractor(s).

The enclosed Tender Drawings are meant for the purpose of defining the scope of work and the broad scheme of installation. The Contractor shall, on award of the work, prepare Working Drawings based on the Tender Drawings and the final Civil, Structural and Interior Drawings; incorporating the final civil dimensions, actual equipment sizes, duct sizes, etc.

1. The Bidders must check and confirm the adequacy of the sizes of the Service/AHU rooms; SA & RA paths, risers, piping installation space, plant & equipment installation space, etc. shown on the Tender Drawings. Where required, bidders shall design & supply equipment of special dimensions to accommodate within available room/space. Absence of any comment from bidder on this matter at the time of tendering shall be taken as confirmation of the adequacy of available spaces without compromise of performance.

2. The Bidders must acquaint themselves with the proposed site, study the HVAC requirements ,specifications, drawings and site conditions before tendering.

3. Quotations incomplete in any respect, or not accompanied by Summary Sheet and all Technical Data stipulated in the Tender Document may be rejected.

4. Specific provisions and stipulations contained in the Schedule of Quantities & Drawings shall have precedence over General Specifications wherever the two differ. In case of contradictions between any provisions of this Document, the more stringent shall prevail.

5. Notwithstanding anything indicated in this Tender Document, all the components of the HVAC system should be selected, designed and installed in such a manner as to prevent objectionable noise or vibrations being transmitted to the conditioned areas.

6. On award of the work and from time to time thereafter, area wise priorities and work sequence shall be informed to the Contractor, based on which the Contractor should submit break-up of the overall completion time in the form of a Bar Chart; and strictly adhere to the same.

7. Contractor shall verify all dimensions at Site before starting actual work. Any discrepancies between the Tender Drawings or Civil Drawings and actual site measurements should be forthwith brought to the notice of the Engineer In-Charge.

8. Special care should be taken to ensure perfect finish, alignment and leveling of all exposed ducts. Quality, workmanship and installation of the same should be excellent and aesthetically pleasing.

9. The supply & return air grilles/diffusers shall be of MS or powder coated Aluminium (as specified) and of superior quality. The colour & finish of the same shall be specified by the Architect/Interior Designer. Before supplying the full lot, the Contractor shall submit samples of grilles & diffusers for the Engineer In-Charge/Architect/Interior Designer's approval.

10. Wherever required, wooden partitions (with insulation if required) above false ceiling shall be provided by other agencies, under guidance of HVAC Contractor

11. All cutouts required for HVAC work should be marked by HVAC Contractor and carried out &sealed after HVAC work, by Civil Contractor (unless part of HVAC BOQ). Site coordination should be done by HVAC Contractor.

12. Door grilles / undercut / half-doors required in toilets doors for intake of air. In the absence of the same, toilet exhaust system cannot work properly due to lack of replacement air.

13. Pro-rata payment for supply of ducting would be made against formed, ready to install ducts and **not** against the supply of GI sheets.

14. The Contractor shall submit complete details & drawings for the related ancillary items like civil work, equipment pedestals, wooden frames for fixing of grilles, ducts, etc; drain, overflow& make-up connections, power supply, wall openings for passing ducts, return air, pipes, etc. Though these items shall be provided by other Agencies, it will be the responsibility of the Contractor to make the necessary markings and to co-ordinate & supervise these items at Site as per the HVAC requirements.

15. The prices and unit rates quoted shall be valid till the completion of the Project. No price escalation shall be permissible in case of increase in raw material /labour prices. No variations, except statutory variations in duties/taxes/levies, on the major HVAC equipment shall be permissible.

16. Compliance with all applicable laws, rules, regulations, labour /ESI/PF formalities and procedures shall be the responsibility of the Contractor.

17. Interpretation of Contract Document:

(a) Except if and to the extent otherwise provided by the contract the provisions of the General Conditions of Contract, Special Conditions of Contract & Schedule of Quantities shall prevail over those of any other documents forming part of the Contract. Several documents forming part the Contract are to be taken as mutually explanatory. Should there be any discrepancy, inconsistency, error or omission in the contracts or any of them, the matter may be referred to the Architect/Engineer In-Charge who shall give his decisions and issue to the Contractor instructions directing in what manner the work is to be carried out. The decision of the Architect/Engineer
In-Charge shall be final and conclusive and the contractor shall carry out work in accordance with this decision.

(b) Works shown upon the drawing but not mentioned in the specifications or descried in the specifications without being shown on the drawings shall nevertheless be held to be included in the same manner as if they had been specifically shown upon the drawings and described in the specifications.

(c) Wherever it is mentioned in the specifications that the Contractor shall perform certain work or provide certain facilities, it is understood that the Contractor shall do so at his own cost.

18. Reduction in Scope of Work:
Though it is intended to award all of the tendered works on turn-key basis, the bidders should also be prepared to accept part of the work, or for exclusion of any item/s which the Client may decide to exclude altogether; or to purchase/obtain directly from other sources and supply the same to the HVAC contractor for installation and integration with his HVAC system. This arrangement shall not affect the HVAC contractor's guarantee or limit his liability. Similarly, if at any time after the commencement of work, the Architect/Client/Engineer In-Charge shall, for any reason whatsoever, not require a whole item or a part thereof as specified in the tender document to be carried out/supplied by the tenderer/contractor, the Client shall be at a liberty to give notice in writing of the fact to the Contractor who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the full amount of the works not having been carried out. Such reduction in the scope of the Contract shall not be considered as a deviation. The Contractor shall, however, be paid for the amount of works actually executed, if any, before the decision of reduction was conveyed to him.

19. Price Break-Up:
Contractor's bills during execution of work shall be based on the priced Schedule of Quantities submitted by the tenderer at the time of tendering (or any revisions there of approved by the Engineer In-Charge). No separate break-up shall be admissible unless approved in writing by the Engineer In-Charge.

20. ADDITIONAL SPECIAL CONDITIONS FOR HVAC WORK

・ The configuration of A/C equipment suggested in this document is based on estimated A/C load, to achieve the specified room temperature during peak load conditions (i.e. on a summer afternoon with full occupancy). Notwithstanding anything stated/specified in this document, it is to be clearly understood that it is the responsibility of the A/C contractor/supplier to achieve and maintain the specified room temperature uniformly in all the air conditioned areas. The bidders are advised to study the civil and A/C drawings and the proposed installation scheme, layout & piping routes, visit the site and carry out comprehensive heat load calculations for each of the Areas, before submitting quotations.

・ Bidders must study the A/C drawings and visit the Site before quoting, and acquaint themselves with the Site conditions, spaces available for condensing & cooling units, air flow, etc. Absence of any comments on this count shall be taken as acceptance of the Site conditions and as a confirmation of adequacy of space available for installation and air flow.

・ Bidders must quote highest models of split A/Cs available in their range. Photographs of all quoted machines shall be submitted with the respective quotation.

・ For all split units having piping length in excess of standard length recommended by the manufacturer, the pipe diameter, especially for liquid line, shall be suitably higher than normal to prevent excessive de-rating in capacity. Where required, traps shall be provided for proper oil return.

・ Refrigerant & drain piping is to be carried out along with the civil & interior works, while the machines are to be installed later. Continuous, joint less copper pipes, preferably hard-drawn, should be used for all piping encased/buried in walls and floor. Contractor will have to carryout thorough pressure testing on completion of piping work. Test pressure shall be 400 PSI and the test duration shall be minimum 24 hours. The pipes shall then be sealed at both ends, retaining Nitrogen gas inside. Responsibility for any leakages found in the piping at anytime, even after the pressure test is approved by the Engineer In-Charge/Client, shall rest with the Contractor; and any expenses

to be incurred due to damage/disturbance/ breakage of the building or interior as a result of any rectification required in the A/C piping shall be borne by the Contractor.

· Exposed & visible piping shall be covered by rigid or braided PVC pipes/sleeves for protection and aesthetics.

· Drain piping shall be tested for leakages by closing the outer end of the drain pipe and then filling water in the entire piping length; before the pipes are buried/encased/concealed. Water shall be retained in the piping till actual commissioning is to be done. On completion of leak test both ends of

the pipes shall be capped to prevent dust, debris, etc. from entering and choking the pipes during construction.

· Megger test shall be carried out by Contractor for checking resistance, insulation and continuity of wires after laying the electrical wires between the cooling & condensing units.

· Any cabling/wiring which is concealed (eg in shafts or above false ceiling), or encased in wall chases, must be installed in conduits to facilitate replacement in case of any fault in future.

· The Contractor shall prepare and submit As-Built drawings showing the exact locations, levels and route of refrigerant & drain pipes, wires and cooling & condensing units. The drawings shall be prepared before the pipes, etc. are concealed.

· All minor items required for the completeness of the installation shall be deemed to be included in the A/C Supplier's scope- whether explicitly mentioned above or not.

· On commissioning, each unit shall be tested by the Contractor to establish actual tonnage and achievement of the stipulated inside conditions. Testing shall be done during peak load conditions.

· The Contractor shall maintain adequate spares at their local office and ensure that prompt after-sales & Guarantee Services are provided.

· Responsibility for co-ordination with other agencies for carrying out civil, carpentry, electrical, etc. works related to the A/C work shall be with the A/C contractor.

TECHNICAL SPECIFICATIONS

1. VARIABLE REFRIGERANT FLOW / VOLUME SYSTEM

1.1 SCOPE

The scope of this section comprise the supply, erection testing and commissioning of inverter based Variable Refrigerant Flow System with Scroll or rotary Compressor confirming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities.

1.2 TYPE

Units shall be air cooled, variable refrigerant flow air conditioner of R410A gas based consisting of outdoor unit and multiple indoor units. Each indoor units having capability to cool or heat as per requirement.

It shall be possible to connect minimum 10 indoor units on one refrigerant circuit. The indoor units on any circuit can be of different type and also controlled individually. Following type of indoor units shall be connected to the system:
Ceiling mounted cassette type
Ceiling mounted Ducted (HS/MS/LS) type
Ceiling suspended type
Wall mounted type
Floor standing type

Compressor installed in the VRV/VRF system should be made by the ORIGINAL EQUIPMENT MANUFACTURER (SAME COMPANY) for which the tendered is having an authorization letter.

Compressor installed in outdoor units shall be equipped with at allinverter compressors. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

Outdoor unit shall be suitable for mix match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor unit shall be capable of extended up to 165 m length from outdoor unit to last indoor units, 1000 m total piping in one outdoor unit's circuit and with maximum 90m level difference without any oil traps.

Both indoor units and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

Condensing Unit (VRF Outdoor Unit- HOT & COLD SYSTEM):

The condensing unit shall be HOT & COLD type, and having Minimum 2 compressors till 24 HP and minimum 4 compressors above 24 HP Out door units with duty cycling for multiple compressor switching starting sequenced for better stability and prolonging equipment life.
The unit shall be provided with own microprocessor control panel. Both indoor and outdoor units shall be factory assembled, tested and filled with first charge of refrigerant. These being very hi-tech in construction with lots of factory checks being conducted, hence no sub assembly should be done at site preferably.

The condensing unit shall be capable of assessing the requirement of liquid refrigerant volumetric Volume of each evaporating unit at all times by means of a sophisticated microprocessor controller and generating the required total volume of refrigerant liquid for supply to the evaporator units.

The condensing unit shall be a factory-assembled unit housed in a sturdy weatherproof casing constructed from rust proof galvanized powder coated steel panels. The noise level of the unit shall not be more than 70dB (A) measured horizontally 1 m away and 1.5 m above base level.

The compressors shall be hermetically sealed reluctance DC type, capable of changing the capacity in accordance to the cooling load requirement. For higher efficiency and improved reliability the inverter compressor shall preferably DC inverter. Oil heater shall be provided in the compressor casing.

The outdoor unit should be fitted with low noise. Aero spiral design fan with aero fitting grill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor for better efficiency. The unit should be capable to deliver 70 pa external static pressure to meet long exhaust duct connection requirement. Unit shall be occupied with an oil recovery system to ensure stable operation with long refrigerant piping lengths.

VRF Outdoor unit:

All outdoor units shall be HOT & COLD type consist of minimum one inverter compressors, Outdoor units when consisting of more than 1 module (e.g. 30 HP = 16 HP +14 HP), each should have minimum one separate inverter driven compressors. In such case, the units shall be provided with duty cycling arrangement for multiple inverter compressors. The outdoor unit shall be modular in design to facilitate installation one after another close to each other. Preference would be given to compact units having smaller footprint. Outdoor units should be rugged of anti-corrosion design and should have strong base plate for easy mounting of unit. The outdoor unit shall comprise of sub-cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping. The condenser coils shall be constructed out of copper tubes mechanically bonded to aluminum fins. The unit shall be with e-pass heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.

All necessary safety devices shall be provided to ensure safe operation of the system.

Unit should be equipped with a highly efficient oil separation system to ensure stable operation with long refrigerant piping.

The VRV condensing unit shall be located in open on a wall /ground /floor place with adequate clearance from nearby objects to ensure unobstructed air flow and easy approach for maintenance.

The Outdoor units shall be suitable for mix-match connection of following type.

Ceiling mounted cassette type (Four way flow)
Ceiling mounted compact cassette (four way flow)
Ceiling mounted cassette type (One way flow)
Ceiling mounted duct type.
Ceiling suspended type.
Wall mounted type
Floor standing type
Concealed floor standing type.

1.8 INDOOR UNIT

Indoor Units (Evaporating Units):

Each VRF based indoor units should be supplied complete with Cordless remote, Drain pump and all accessories, Vibration isolators & supports,Including all electical control panel. (Bidder To offer nearest size of the Unit available)

Each unit shall be selected as the requirement of the cooling load and interior layout in the respective space to be air-conditioned. The unit shall be equipped with an electronic expansion valve, which can communicate with the VRV controller in the condensing unit.

The fan shall of the dual suction multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation.

Each indoor unit shall be equipped with cordless local control unit for setting the operating parameters. The address of the indoor unit shall be set automatically in case of individual and group control. Option of centralized control should also be achievable.

Controls shall be provided to maintain the set room temperature within close tolerance limits.

1.8.2 Ceiling Mounted Cassette Type Unit (Multi Flow Type)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners.

Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision (if specified) Law gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts for fresh air.

1.8.3 Ceiling Mounted Ductable Type Unit

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section and DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

Ceiling Suspended Type

Unit shall be suitable for ceiling suspended arrangement below false ceiling.

The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

High Wall Mounted Units

Unit shall be suitable for Wall Mounting arrangement. The unit includes pre filter, fan section and DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

1.8.6 Floor Standing VRV Package type units

Unit shall be suitable for Floor standing arrangement. The unit includes pre filter, fan section and DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

1.9 CENTRAL CONTROLLER W/o PC Monitering :

CENTRAL CONTROLLER System should have facilities for start, stop, temperature setting, fan speed control, mode control, Group control, emergency start & stop, BMS access and fault Diagnosis functions.

A Remote Control Unit shall be provided for the system, suitable to be mounted near the entrance door of the premises. It should be possible to operate the entire air conditioning system and set working parameters of all indoor units and the VRV outdoor unit from this control unit. The unit shall be equipped with self-diagnosis for easy and quick maintenance and service. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall be equipped with a battery back-up and a real time clock.

Unified ON/OFF controller shall be supplied as indicated in Schedule of Quantities.

The controller shall be able to control minimum 15 groups (each group containing maximum 16 indoor units) or 128 nos. of indoor units with the following functions:

On / off as a zone or individual unit.

Indication of operation condition of each group.

Select one of 4 operation modes.

1.10 SCHEDULE TIMER

A schedule timer shall be supplied as indicated in Schedule of quantities.

a. The timer shall be able to set operation schedule for all indoor units.

b. The timer shall be able to set 8 pattern of schedule combined with centralized controller.

1.11 REFRIGERANT PIPING

The refrigerant piping interconnecting to indoor & outdoor units shall be made out of hard copper tubes, in brazed construction. The refrigerant line sizing should be designed to achieve minimum pressure drop and avoid oil return problem. The pipe sizes and connections shall be designed such that the evaporator units do not face back pressure due to the functioning of the evaporator next to it.

Piping should be shrouded, where necessary, to protect it from accidental damage/leaks during work by any agencies.The expose piping covered with U.V.protection tape, supported by M.S.ledger.

All the wiring interconnecting the indoor and outdoor units shall be PVC insulated copper conductor flexible wires of appropriate rating, and shall be laid through PVC conduits.

All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 38Kg per sq. cm. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum if 700 mm hg and held for 24 hours.

The air conditioning system supplier shall be design sizes and erect proper interconnections of the complete refrigerant circuit.

The thickness of copper piping shall not be less than mentioned below:

Pipe size in mm (OD)	Copper Pipe / Insulation Thickness
41.3	1.0 / 19
38.1	1.0 / 19
34.9	1.0 / 19
31.8	1.0 / 19
28.6	1.0 / 19
25.4	1.0 / 19
22.2	1.0 / 19
19.1	1.0 / 19
15.9	1.0 / 19
12.7	0.8 / 19
9.5	0.8 / 19
6.4	0.8 / 19

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

To protect nitrile rubber insulation of exposed copper piping from degrading due ultra violet rays & atmospheric condition, it shall be covered polyshield coating with atleast two coats of resin and hardner above nitrile rubber insulation. Fiberglass tape shall be helically wound & coated with painted two coats of resin with hardner to give smooth & plain finish.

2.0 INTERCONNECTING REFRIGERANT PIPING & WIRING

The refrigerant piping interconnecting to indoor & outdoor units shall be of copper and shall be joined by brazed type joints.

The set of two refrigeration lines and the wires shall be bundled together for protection from accidental damage as well as rodents.

All pipe supports/clamps shall be painted with red oxide primer followed by 2 coats of synthetic enamel finish paint.

The piping and wiring shall be laid such that it does not spoil the aesthetics of the premises, and is safe, secure and approachable for repair/replacement.

1.12 PIPE INSULATION

a. Refrigerant Pipe Insulation

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm thick O class elastomeric nitrile rubber as specified in BOQ.

Exposed Refrigerent piping should be additionally insulated with factory laminated 200 GSM glass cloth for UV and mechanical protection and manufacturer recommended adhesive (solvent-free) sealant applied at all joints. Refrigerent pipes on terrace or platform shall be installed on raised GI Cable tray and finally covered with GI Sheet Cover for protection. Rates should include the same.along with 19mm O class Nitrile insulation and supports, between indoor & outdoor units duly insulated as per Drawing. All piping inside the room in ceilling shall be properly supported in cable tray

Drain Pipe Insulation
The drain piping shall be made out of rigid PVC pipes of 10 Kg/cm2 class.

Drain pipes carrying condensate water shall be insulated with 6 mm thick elastomeric nitrile rubber insulation.

For proper drainage of condensate, U Trap shall be provided in the drain piping (wherever required). All pipe supports shall be of pre fabricated& pre painted slotted angle supports, properly installed with clamps etc.

LIST OF APPROVED MAKES FOR EQUIPMENT AND MATERIAL.

Sr. No.	Details of Materials / Equipment	Manufacturer's Name
1	VRV / VRF	Daikin/ Carrier / Mitsubishi HEAVY / O-General
2	GI Sheet	Tata Jindal Nippon Essar
3	Grilles / Diffusers	Carryaire Cosmos Dynacraft Radical System Air
4	Fire Dampers	Carryaire Cosmos Dynacraft Radical System Air
5	Anchor Fastners	Hilti Fischer
6	Insulation - Closed Cell Elestomeric nitrile rubber	Armacell, Superlon, Aroflex, Paramount
7	UPVC Pipes	Supreme / Prince/ Vitco / Finolex / Astral
8	Cables	Finolex, Polycab, R.R Kabel
9	Copper Pipe	Mandev, Rajco, Totline, Maxflow RR
10	ACCOUSTIC LINNING	KIMMCO/ LLOYD/ UP TWIGA/ OWENS COMING
11	TFA	Ethos / Citizen/ Zeco
12	Condensing Unit for TFA	Daikin/ Carrier