Indian Institute of Information Technology Sri City, Chittoor

NOTICE INVITING TENDER

Tender Notice No.: IIITS/NIT/HVAC/2025/037, Dt. 11.12.2025

Online tenders are invited from resourceful agencies for **"Supply, Installation, Testing and Commissioning of VRV / VRF Type Air Conditioning System for labs and other areas in NW Academic Block of Indian Institute of Information Technology Sri City, Chittoor as per the requirements & specification"** addressed to the Dean - Infrastructure & Planning, IIIT Sri City, Chittoor and submit all specified documents.

Bid Issue Date	11th December 2025
Clarification Start Date & Time	11th December 2025 at 17:00 Hrs
Clarifications End Date & Time [through mail only]	17th December 2025 up to 17:00 Hrs
Pre-bid meeting	18th December 2025 @ 11:00 Hrs
Last Date for submission of e-bids	25th December 2025 @ 16:00 Hrs
Due Date for opening of e-bids	26th December 2025 @ 16:00 Hrs
Submission of offer	E-Tender in Two bid System through CPP Portal ENVELOPE 1: Technical Bid ENVELOPE 2: Financial Bid
Address for submission	**E-Tender through CPP Portal only** https://etenders.gov.in/eprocure/app
Earnest Money Deposit (EMD)	The Earnest Money Deposit amounting to Rs. 1,00,000/- (Rupees One lakh only) must be deposited through RTGS / NEFT to IIIT Sri City Chittoor Opex Account (Bank details are available in Page 3)

Supply, Installation, Testing and Commissioning of VRV / VRF Type Air Conditioning System for labs and other areas in Academic Block of Indian Institute of Information Technology Sri City, Chittoor as per the requirements & specification

PART – I

TECHNICAL BID

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SECTION 1: INSTRUCTIONS FOR SUBMISSION OF ONLINE BID

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal. More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.

REGISTRATION

1. Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal URL: https://etenders.gov.in/eprocure/app by clicking on "Online Bidder Enrollment" on the CPP Portal which is free of charge.

2. As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

3. Bidders are advised to register their valid email and mobile number(s) as part of the registration process. These would be used for any communication from the CPP Portal.

4. Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.)

5. Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.

6. Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

SEARCHING FOR TENDER DOCUMENTS

7. There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

8. Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective "My Tender" folder. This would enable the CPP Portal to intimate the bidders through SMS / email in case there is any corrigendum issued to the tender document.

9. The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

10. Bidder should take into account any corrigendum published on the tender document before submitting their bids.

11. Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

12. Bidder, in advance, should prepare the bid documents to be submitted as indicated in the tender document / schedule and generally shall be in PDF / XLS / RAR / DWF / JPG formats as the case may be. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

13. To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every Bid, a provision of uploading such standard documents (e.g. PAN card copy, GSTIN Details, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Documents" area available to them to upload such documents. These documents may be directly submitted from the "My Documents" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

SUBMISSION OF BIDS.

14. Bidder should log into the site well in advance for bid submission so that he/she upload the Bid in time i.e. on or before the bid submission date and time. Bidder will be responsible for any delay due to other issues. The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

15. Bidder has to select the payment option as “offline” to pay the tender fee / EMD as applicable and enter details of the instrument. A standard BOQ format has been provided with the tender document to be filled by all the bidders.

16. Bidders are requested to note that they should submit their financial bids in the format provided and that no other format is acceptable. Bidders are required to download the BOQ file, open it and complete the detail with their respective financial quotes and other details (such as the bidder's name). If the BOQ file is found to be modified by the bidder, the Bid will be rejected.

17. The server time (displayed on the bidders' dashboard) will be considered the standard time for referencing the deadlines for submitting bids by the bidders, opening of bids, etc. The bidders should follow this time during bid submission.

18. The Tender Inviting Authority will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders due to local issues.

19. The uploaded tender documents become readable only to public view after the tender opening by authorized bid openers.

20. Upon the successful and timely submission of bids, the portal will give a successful bid submission message & a bid summary will be displayed with the Bid no. and the Date & time of submission of the Bid with all other relevant details.

21. Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

22. Any queries relating to online bid submission or CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.

NOTICE INVITING TENDER

IIIT Sri City invites e-tenders in two cover system from the eligible bidders for the Supply, Installation, Testing and Commissioning of VRV / VRF Type Air Conditioning System.

GENERAL CONDITIONS OF CONTRACT

1. **Tender Documents:** The interested parties may download from web-site https://etenders.gov.in/eprocure/app and from https://www.iiits.ac.in/tenders/

2. Bidders are advised to visit the website frequently to find any addendum/ Corrigendum issued for extension of due date for submission, etc. No separate intimation will be issued /advertised in this regard.

3. You are requested to go through the terms and conditions carefully and also visit / inspect the site to familiarize and submit your tender as per procedure explained in the tender document.

4. The tenderer(s) if required, may submit queries, if any, through E-mail to tenders.2024@iiits.in to seek clarifications. IIIT Sri City will reply only those queries which are essentially required for submission of bids. IIIT Sri City will not reply the queries which are not considered fit like replies of which can be implied /found in the NIT/ Tender Documents or which are not relevant or in contravention to NIT/Tender Documents or queries received after stipulated, extension of time for opening of technical bids, etc.

5. Technical Bids will be open on the scheduled dates. Requests for extension of opening of Technical Bids will not be entertained.

6. **Earnest Money Deposit:**
   The Earnest Money Deposit amounting to Rs. 1,00,000/- (Rupees One Lakh Rupees only) must be credited in the form of NEFT/RTGS to "IIIT Sri City Chittoor Opex Account" (A/c. No. 110167506587, IFSC Code. CNRB0013247, Sri City Branch, Tirupati District, AP - 517 646. The firms / agencies / bidders registered **as MSME** are exempted from paying theEMD amount as per the government orders.

7. **Completion Time:** All the specified works shall be completed **within 2 months** of award of work including necessary approval if any.

8. **Site Visit:** Before tendering, every bidder is advised to inspect the site/locations of work and its environments between Monday to Saturday from 10:00 Hrs to 16:00 Hrs except Sunday and Govt. holidays, to ascertain the exact requirement of the NIT, at his own cost. The visiting bidder has to obtain the site visit confirmation certificate from the Engineering Unit Office of IIITS and it should be submitted along with the technical bid submission

9. Minimum Eligibility Criteria:

(i) Satisfactory completion of at least **(Values excluding GST paid)**
   a. three similar works each of value not less than Rs. 15.00 lakh or
   b. two similar works each of value not less than Rs. 20.00 lakh or
   c. one work of value not less than Rs. 25.00 lakh in last 5 years (year ending March, 2025).

(ii) Similar work shall mean works of Supply, installation, testing and commissioning of VRV / VRF AC in a 3 storied building in any University, reputed educational institute, Government Organizations and reputed companies during last 5 financial years ending 31st March 2025. This should be supported by completion certificate issued by an officer not below the rank of Superintending Engineer / Chief Project Manager or equivalent of the organizations from whom the work has been done.

(iii) The tenderer should have average annual financial turnover of Rs. 25.00 lakh of supply and installation of Air Conditioning work during the last three years ending 31st March, 2025. The turnover certificate to be form an authorized licensed auditing firm.

(iv) The tenderer shall be working in the field of supply, installation, testing & commissioning of VRV / VRF AC works for the past 5 years consistently.

(v) The tenderer should have valid registration for GST and should have Permanent Account Number (PAN).

(vi) Documentary evidences for work experience, turnover, GST, PAN, Site visit certificate all as indicated & required in the tender document should be furnished without which it will not be taken into account.

10. If the date of opening of the tender is declared as holiday, it will be opened on the next working day at the same time.

11. Bid Evaluation:

The Technical Evaluation Committee (TEC) constituted by the competent authority, IIIT Sri City Chittoor will open the technical bid to decide the technical suitability of their service based on the pre-laid terms and conditions. Appropriate norms as stipulated in the NIT will be decided by the committee before the opening of the technical bid for evaluation of bids. After the evaluation of the technical aspects of the bid the committee will give suitable recommendations about the shortlisted firms. The recommendation of the TEC shall be final and binding on all the parties. Further, the TEC may seek additional information from the existing users at IIIT Sri City Chittoor or from other Institutes.

12. IIIT Sri City reserves the right:

a. To accept or reject any or all Tenders either in whole or in part or to invite revised price bids or to annul the bidding process
b. To postpone and/or extend the date of receipt/opening of quotation or to withdraw the same at any time before finalization without incurring any liability

to the affected Tenderer / Bidder.

c. To omit/delete any item(s) of work from the schedule at the time of allotment or before the commencement of work or during execution of work without assigning any reason whatsoever.
d. To change the quantity or add the item or cancel the item/service required.
e. To accept or reject any or all the Tenders without assigning any reason.

13. Bids shall be adjudged as non-responsive due to any of the following reasons:
    (a) Bids submitted without Earnest money, or without proof for EMD exemption.
    (b) Bids submitted without certificate(s) in respect of the financial and technical qualification criteria.
    (c) Bids submitted without documents to establish the eligibility criteria.
    (d) Bids submitted without photocopies of the receipted copies of GST, IT and PF Returns from the respective Competent Authority.
    (e) Bids without site visit confirmation certificate issued by Engineering Unit of IIITS
    (f) Any other reason as applicable.

14. Bidders shall clearly indicate their legal constitution and the person signing the bid shall state his capacity and also the source of his ability to bind the bidder. The power of attorney or authorization or any other document constituting adequate proof of the ability of the signatory to bind the bidder shall be annexed to the bid.

    The owner may reject outright any bid unsupported by inadequate proof of the signatory's authority.

15. The bid document shall be completed in all respects and shall be submitted online together with the requisite information and appendices. They shall be completed and free from ambiguity, change or inter-lineation.

16. IIIT Sri City shall have a unqualified option under the said bid bond to forfeit the EMD in the event of Bidder failing to keep the bid valid upto the date specified or refusing to accept work or carry it out in accordance with the bid if the IIIT Sri City decides to award the work to the Bidder.

17. The EMD shall be retained with the IIIT Sri City until finalization of tenders. If any statements documents/information submitted by tenderer is found false/incorrect, willful misrepresented or omission of facts or fake/forged documents, the EMD shall be forfeited.

18. IIIT Sri City shall, however, release the EMD in respect of unsuccessful bidders within 30 (thirty) days of placement of order to successful bidder. No interest shall be payable on EMD by IIIT Sri City. EMD of successful bidder will be converted into security refundable deposit. In case of any breach of contract, EMD will be forfeited.

19. The works shall be carried out in the buildings as per the directions of Engineer In-

Charge, Safety procedure, specifications and standard code of practice.

20. Works shall be awarded to L1 tenderer on L1 quoted rates. Price quoted by tenderer shall be fixed and not subject to any escalation whatsoever during the period of execution of the contract including the extended period, if any.

21. This tender notice shall be deemed to form an integral part of the contract to be entered into for this work.

22. **The successful bidder should submit Shop drawing(s) / Material Approvals / Method statements for approval from official concerned from IIIT Sri City prior to execution of the work.**

23. The successful bidder needs to arrange for the required materials, tools & plants including **scaffolding & staging** and manpower to the locations at his own cost as per the scope of the work. Accommodation and Transportation should be arranged by contractor themselves.

24. The successful bidder has to ensure the safety of the manpower/vehicles deployed in the premises. IIIT Sri City will not be responsible for any incident arising during execution of the work.

25. Water for works shall be provided by IIIT. Electricity for work shall be provided on request by the contractor after approval of the competent authority.

26. **PAYMENT TERMS:**

The following percentage of contract rates for the various items included in the contract shall be payable against the stage of work shown herein.

a. 35% towards supply of materials after initial inspection and delivery at site in good condition of pro-rata basis.
b. 35% after completion of installation in all respect.
c. Balance 30% will be paid after testing, commissioning trial run & handing over to the Institute for beneficial use.
d. No advance payment will be made.
e. Any payment will be released only after satisfactory completion of the work and after submission of the certified bill (s) / invoice(s) as per the schedule for payment within 30 days from the date of certification of the invoices Bills.
f. Payment will be made through on-line upon submission of bills. TDS will be deducted as per rules.

27. **Security Deposit:** Security Deposit shall be deducted from each running bill and the final bill to the extent of 5% of the gross amount payable subject to maximum limit of 5% of the tendered value of work. The security deposit shall be released on the expiry of the defect liability period stipulated in the contract.

28. PERFORMANCE GUARANTEE:

The successful tenderer shall submit an irrevocable performance guarantee of 5% of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement within 15 days of issue of letter of intent (LOI). This guarantee shall be in the form of government securities or fixed deposit receipts or guarantee bonds or Demand draft of any scheduled bank or the State Bank of India in the specified format. The performance guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond. This bank guarantee shall be kept valid till the recording of completion certificate for the work by the Competent Authority.

29. **TAXES AND DUTIES:** The Rates unless otherwise specified, will be deemed to exclude sales tax or GST or any other taxes and duties, which are in force or may be levied by the Central/State/Local Governments from time to time, on the production and sale of the goods.

30. Right of Rejection:

The IIIT Sri City reserves the right to reject any proposal that does not address all the requirements of the NIT. In addition, the IIIT Sri City reserves the right to accept or reject any proposal submitted by the tenderers, and to cancel the NIT process and reject all proposal submissions at any time, without thereby incurring any liability to the affected Consultant or any obligation to inform the affected tenderer the grounds for IIIT Sri City action.

31. FORCE MAJEURE

IIIT Sri City, Chittoor may consider relaxing the penalty and delivery requirements, as specified in this document, if and to the extent that the delay, in performance or other failure to perform its obligations under the contract, is the result of a force majeure.

32. ARBITRATION

All disputes of any kind arising out of supply, commissioning, acceptance, warranty maintenance etc., shall be referred by either party (IIIT Sri City, Chittoor or the bidder) after issuance of 30 days' notice in writing to the other party clearly mentioning the nature of dispute and will be referred to the arbitrator to be nominated by The Director, IIIT Sri City, Chittoor. The Venue for arbitration shall be Tirupati District, Andhra Pradesh – 517 646.

33. **JURISDICTION:** All the disputes arising out of this order shall have exclusive jurisdiction of Tirupati, Andhra Pradesh only.

SPECIAL CONDITIONS

1. Rates:

1.1 The rates quoted by the tenderer, shall be firm and inclusive of all taxes (including works contract taxes), duties and levies, octroi and all charges for packing forwarding, insurance, freight and delivery, installation, testing, commissioning etc. at site temporary constructional storage, risks, overhead charges general liabilities /obligations and clearance form local authorities. However, the fee for inspections shall NOT be borne by the Institute.

1.2 The contractor has to carry out routine & preventive maintenance for 12 months from the date of handing over. Nothing extra shall be paid.

2. Completeness of tender:

2.1 All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespective of the fact whether such items are specifically mentioned in the tender documents or not.

2.2 For item/equipment requiring initial inspection at manufacturer's works, the contractor will intimate the date of testing of equipment's at the manufacturer's works before dispatch. The Institute also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make the arrangement for the same. The successful tenderer shall give sufficient advance notice regarding the dates proposed for such tests/inspection to the Institute's representative(s) to facilities his presence during testing/fabrication. The Engineer-in-charge at his discretion may witness such testing/fabrication. The cost of the Engineer's visit to the factory will be borne by the contractor. Also equipment may be inspected at the manufacturer's premises, before dispatch to the site by the contractor.

3. Storage and custody of materials:

The agency has to make his own arrangements for storage of sundry materials and erection equipment's. No separate storage accommodation shall be provided by the Institute. Watch and ward of the stores and their safe custody shall be responsibility of the contractor till the final taking over the installation by the Institute.

4. Care of the Building:

Care shall be taken by the contractor while handling and installing the various equipment's and components of the work to avoid damage to the building. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost. He shall also remove at his cost all unwanted and waste materials arising out of the installation from the site of work.

5. Completion of period

The completion period of **two (2) months** indicated in the tender documents is for the entire work of supply, installation, testing, commissioning and handing over of the entire system to the satisfaction of the Engineer-in-charge.

6. Guarantee

All equipment's shall be guaranteed for a period of 12 months or as per the OEM standard form the date of taking over the installation by the Institute against unsatisfactory performance and/or break down due to defective design, workmanship of material. The equipment's of components or any part thereof, so found defective during guarantee period shall be forth with repaired or replaced free of cost, to the satisfaction of the Engineer-in- charge. In case it is felt by the Institute that undue delay is being caused by the contractor in doing this, the same will be got done by the Institute at the risk and cost of the contractor. The decision of the Engineer-in-charge in this regard shall be final.

7. Compensation for Delay/Liquidated damages:

The contractor is to complete his work under this contract on or-before the date mentioned in the tender failing which he shall be subject to pay or allow deduction of one (1) percent on the total amount of the contract for every week of delay subject to a total deduction of 10% of the tender value/agreement amount or the value of final bill whichever is more as liquidated damages to the IIIT Sri City.

8. If the contractor shall be hindered in the supply of the materials so as to necessitate an extension of the time allowed in this tender, he shall apply in writing to the Engineer-in- charge who shall grant it in writing if there are reasonable ground for it, and without such Authority in writing by the Engineer-in-charge, the contractor shall not claim exempted from the LD leviable under Clause 8. For the completion of the rest of the works the contractor shall be entitled such extension of time as may be determined by the Engineer-in-charge.

9. The contractor shall inform the Engineer-in-charge of his intention of making delivery of materials and on the materials being approved the Engineer-in-charge or his authorized representative shall grant a receipt to him no material will be considered as delivered until so approved.

10. On the completion of the delivery of material the contractor shall be furnished with a certificate to that effect by the Engineer-in-charge but the delivery will not be considered complete until the contractor shall have removed all rejected materials and shall have the approved materials stocked or placed in such positions as be pointed out to him.

11. The materials shall be of the best description and in strict accordance with the specification and the contractor shall receive payment for such materials only as are approved and passed by the Engineer-in-charge.

12. Power Supply

Electric service connection of 415 V, 3 Phase, 4 Wire, 50 Hz, AC supply shall be

provided by the Institute for installation purpose on written request and after approval of the competent authority.

13. Water Supply

Water supply shall be made available by the Institute at one point.

14. Data Manual and Drawings to be furnished by the tenderers:

The tenderer shall furnish along with the tender, detailed technical literature, pamphlets and performance data for appraisals and evaluation of the offer.

15. After Award of work

(i) The successful tenderer would be required to submit the following within a month of award of work for approval before commencement of installation.
   (a) All general arrangement drawings.
   (b) Details of the equipment, load, location etc. of various assembled equipment.
   (c) Complete layout dimensions for every unit/group of units with dimensions required for installation purposes.
   (d) Any other drawing/information not specifically mentioned above but deemed to be necessary for the job by the contractor.

16. The successful tenderer should furnish well in advance three copies each of detailed instructions and manuals of manufactures for all items of equipment's regarding installation, adjustments operation and maintenance preventive maintenance & trouble shooting together with all the relevant data sheets, spare parts catalogue and workshop procedure for repairs, assembly and adjustment etc. all in triplicate.

17. Extent of work

17.1 The work shall comprise of entire labour including supervision and all materials necessary to make a complete installation and such tests and adjustments and commissioning as may be required by the Institute. The terms complete installation shall not only mean major items of the plant and equipment's covered by specifications but all incidental sundry components necessary for complete execution and satisfactory performance of installation with all layout charges whether or not those have been mentioned in details in the tender document in connection with this contract. Including the power taping for IDU & ODU with required wirings, DB's, MCB's etc, Power source will be given by IIITS at one location.

17.2 Minor building works necessary for installing of equipment, foundation, making of opening in walls or in floors and restoring to their original condition, finish and necessary grouting etc. as required.

17.3 Maintenance (Routine & Preventive) for one year from date of completion and handing over.

17.4 The work is a turnkey project. Any item required including Electrical works as required for completion of the project but left inadvertently shall be executed with in the quoted rates.

18. Inspection and testing:

18.1 Copies of all documents of routine and type test certificates of the equipment, carried out at the manufacturers premises shall be furnished to the Engineer-in-charge and consignee.

18.2 After completion of the work in all respect the contractor shall offer the installation for testing and operation.

19. Validity

Tenders shall be valid for acceptance for a period of 150 days from the date ofopening of price bid.

20. Compliance with regulations and Indian standards

20.1 All works shall be carried out in accordance with relevant regulation, both statutory and those specified by the Indian Standards related to the works covered by this specification. In particular, the equipment and installation will comply with the following:

(i) Factories Act.

(ii) Indian Electricity Rules.

(iii) IS & BS Standards as applicable.

(iv) Workmen's compensation Act.

(v) Statutory norms prescribed by local bodies like CEA, NDMC etc.

20.2 Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the Supply and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes.

20.3 Successful tenderer shall arrange for compliance with statutory provisions of safety regulations and Institute's requirements of safety codes in respect of labor employed on the work by the tenderer. Failure to provide such safety requirement would make the tenderer liable for penalty of Rs. 250/- for each default. In addition, the Institute will be at liberty to make arrangement for the safety requirements at the cost of tenderer and recover the cost thereof from him.

21. Indemnity

The successful tenderer shall at all times indemnify the Institute, consequent on this works contract. The successful tenderer shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause and the Institute shall not be responsible for any accident or damage incurred or claims arising therefrom during the period of erection, construction and putting into operation the equipment's and ancillary equipment under the supervision of the successful tenderer in so far as the latter is responsible. The successful tenderer shallalso provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the successful tenderer due to the above.

22. Erection Tools

No tools and tackles either for unloading or for shifting the equipment's for erections purposes would be made available by the Institute. The successful tenderer shall make his own arrangement for all these facilities.

23. Cooperation with other agencies

The successful tenderer shall co-ordinate with other contractors and agencies engaged in the construction of building, if any, exchange freely all technical information so as to make the execution of this works contract smooth. No remuneration should be claimed from the Institute for such technical cooperation. If any unreasonable hindrance is caused to other agencies and any completed portion of the work has to be dismantled and re-done for want of cooperation and coordination by the successful tenderer during the course of work, such expenditure incurred will be recovered from the successful tenderer if the restoration work to the original condition or specification of the dismantled portion of the work was not undertaken by the successful tenderer himself.

24. Mobilization Advance

No mobilization advance shall be paid for this work.

25. Insurance and Storage

All consignments are to be duly insured the cost of the contractor. The insurance covers shall be valid till the equipment is handed over duly installed, tested and commissioned.

26. Verification of correctness of Equipment at Destination

The contractor shall have to produce all the relevant records to certify that the genuine equipment from the manufactures has been supplied and erected.

27. Painting

This shall include cost of painting of entire exposed iron work complete in the installation. All equipment's works shall be painted at the works before dispatch to the site.

28. Training

The scope of works includes on job technical training of two persons at site. Nothing extra shall be payable on this account.

29. Maintenance

29.1 Sufficient trained and experienced staff shall be made available to meet any exigency of work during the guarantee period of one year from the handing over of the installation.

29.2 The maintenance, routine as well as preventive for one year from the date of taking over the installation as per manufacturer's recommendation shall be carried

out and the record of the same shall have to be maintained.

29.3 Final inspection and servicing to be done at the end of the 1year Defect Liability Period and obtain clearance certificate from the IIIT Sri City Facilities management section (End users), to close the contract and to release the withheld security Deposit amount.

30. Interpreting Specifications

In interpreting the specifications, the following order of decreasing importance shall be followed in case of contradictions:

(a) Schedule of quantities
(b) Technical specifications
(c) Drawing (if any)
(d) General Specifications
(e) Relevant IS or other international code in case IS code is not available.

31. On account of security consideration, some restrictions may be imposed by the security staff on the working and/ movement of men and materials etc. The contractor will be bound to follow all such restrictions/ instructions and he shall organize his work accordingly. No claim on this account, whatsoever, shall be payable.

TECHNICAL SPECIFICATION

I AIRCOOLED VARIABLE REFRIGERANT VOLUME SYSTEM

1.1 SCOPE

The scope of this section comprises the supply, erection testing and commissioning of Variable Refrigerant Volume System conforming 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 volume air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor units having capability to cool or heat independently for the requirement of the rooms.

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 (Double flow)
- Ceiling mounted cassette type (Multi flow)
- Ceiling mounted Low Static Duct type
- Ceiling mounted Built in Ductable type
- Ceiling mounted Duct type
- Ceiling suspended type
- Wall mounted type
- Floor standing type

Outdoor unit shall be equipped with at least one inverter / digital compressor and minimum two inverter / digital compressors in bigger machines for higher reliability, improved life, better backup and duty cycling purpose. 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 possible to extend up to 150m with maximum 50m 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.

Minimum COP of VRV units shall be 3.7 at 100% load.

1.3 OUTDOOR UNIT

The outdoor unit shall be factory assembled, weatherproof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory-written, tested with all necessary controls:

a) All outdoor units shall have minimum two scroll compressors and be able to operate even in case one of compressor is out of order.
b) Each outdoor unit shall have one inverter compressor for variable speed.
c) It should also be provided with duty cycling for multiple inverter compressor switching starting sequence for better stability and prolonging equipment life.
d) The outdoor unit shall be modular in design and should be allowed for side-by-side installation.
e) The unit shall be provided with its own microprocessor control panel.
f) The outdoor units should have anti-corrosion paint free gal barium base plate for easy mounting of unit.
g) The machine must have a sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.

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 also be capable to deliver 55 Pa external static pressure to meet long exhaust duct connection requirement.

The condensing unit shall be designed to operate safely when connected to multiple fan coil units

a. Each condensing unit shall be complete unit with hermetic compressor/s, air cooled condenser, condenser fans with motors, internal piping, switches and internal wiring and shall be enclosed in a corrosion resistant, epoxy coated weatherproof outdoor type housing.

b. The compressor shall be VRV with Twin/ Triple compressor control. The compressors shall be suitable for R-410a. The optimum capacity control shall be of multiple compressors in accordance with load.

c. The condenser coil shall be air cooled type with aluminum fins and copper tubes and necessary refrigerant connections. The copper tubes shall not be less than 1/2" O.D.

d. The condenser air fans shall be propeller type direct driven, each complete with motor. The air quantity and area of the condenser shall be adequate for working in the specified outdoor conditions.

e. The casing shall be fabricated from galvanized steel zinc phosphate and finished with epoxy coating. The casing shall make the whole unit fully weatherproof, suitable for outdoor installation on the sea side.

f. The unit shall include a remote-control assembly with thermostat and starting and speed switches.

g. The necessary charge of refrigerant gas and lubricated oil shall be provided to run the system

NOTE: The Outdoor machines shall be preferably compact machines for purpose of space saving and smaller footprint shall be preferred.

1.4 COMPRESSOR

The compressor shall be highly efficient scroll type and capable of inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement:

a) All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.

b) Oil heater shall be provided in the compressor casing.

c) The Inverter compressor shall preferably be Reluctance DC inverter compressor for higher efficiency and improved reliability.

1.5 HEAT EXCHANGER

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross-fin coil.

a) The aluminum fins shall be covered by anti-corrosion resin film.
b) The unit should be with e-pass heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.
c) The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.
d) The cooling unit shall be matched to condensing units and shall consist of cooling coil, blower, filters, outer casing, drain pan, accessories etc.
e) The cooling coil shall have copper tubes of not less than 3/8" O.D. and continuous aluminum plate fins with integral collars. The tubes shall be staggered in the direction of air flow.
f) The fan section shall comprise of 1 no. Aluminum /industrial plastic centrifugal blower, statically and dynamically balanced motor, drive package, mounting arrangement etc.
g) The unit shall include a cordless remote-control assembly with thermostat and starter and 3 speed switches.

1.6 REFRIGERANT CIRCUIT

a. The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valve at condenser end.

b. The equipment must have in built refrigerant stabilization control for proper refrigerant distribution.

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

1.7 SAFETY DEVICES

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

Following safety devices shall be part of outdoor unit; high pressure switch, fuse, fan drive overload protector, fusible plug, over load relay, overload protection for inverter.

1.8 OIL RECOVERY SYSTEM

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths.

The system must be provided with oil balancing circuit to avoid poor lubrication.

1.9 INDOOR UNIT

This section deals with supply, installation, testing, commissioning of various type of indoor units confirming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in detailed Bill Of Quantities

GENERAL

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

a) The address of the indoor unit shall be set automatically in case of individual and group control.

b) In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coil shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally molded plastic frame. The filter shall be slide away type and neatly inserted.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling or cooling and heating.
Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

1.9.1 **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. The fan shall be aerodynamically designed diffuser turbo fan type.

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) Low 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.

1.9.2 **CEILING MOUNTED DUCTABLE TYPE UNIT**

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & 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.

1.9.3 **HIGH WALL MOUNTED UNITS**

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

Unit shall have an attractive external casing for supply and return air.

II SPLIT SYSTEM AIR CONDITIONERS

1. **General:**

The contractor shall supply and install split system air conditioners wherever indicated. The system shall be complete in all respects and comply with the specifications as given.

2. **Condensing Units:**

2.1 Each condensing unit shall be complete unit with hermetic reciprocating/scroll compressor/s, air-cooled condenser, condenser fans with motors, internal piping, switches and internal wiring and shall be enclosed in a weatherproof out-door type housing.

2.2 The compressor shall be hermetic, with enclosed gas cooled motor. The compressors shall be suitable for R-32/R-410/R-410a.

2.3 The condenser coil shall be air cooled type with aluminum fins and copper tubes and necessary refrigerant connections. The copper tubes shall not be less than 1/2" O.D.

2.4 The condenser air fans shall be propeller type direct driven, each complete with motor. The air quantity and area of the condenser shall be adequate for working in the specified

outdoor conditions.

2.5 The casing shall be fabricated from galvanized steel, zinc phosphate and finished with baked enamel paint. The casing shall make the whole unit fully weatherproof, suitable for outdoor installation.

2.6 The unit shall include a remote-control assembly with thermostat and speed switches.

2.7 The necessary charge of refrigerant gas and lubricated oil shall be provided to run the system. Providing and fixing M.S. structural support for condensing unit with vibration isolator pad in-between support and structure and vibration isolation suspender and pads for evaporating units.

3. **Indoor Units**

General:

The indoor units shall be complete in all respects and shall generally comply with the specifications as given in the following paragraphs.

3.1 **High Wall Mounted Type:**

The unit shall be decorative wall mounted type. The cabinet is constructed out of durable flame resistance body and shall include pre filter, fan section, coil section, etc. The body shall be light in weight. The indoor unit shall be of approved model & colour by Engineer-in-charge.
The fan shall be aerodynamically designed diffuser turbo fan type. The fan shall be mounted directly on motor shaft having supported from housing. The fan shall be direct driven type.

The cooling coil shall be of seamless copper tubes, and shall have continuous aluminum fins. The fins shall be spaced by collars forming integral part of the fins.

The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes. The coils shall be tested against leaks.

Unit shall have filter cleanable type of resin net (with mold resistant) fixed to an integrally molded plastic frame. The filter should be slid away type but neatly inserted.

Unit shall have a external attractive casing for supply and return air.

Control:

Each unit shall be with corded remote controller to operate maintain inside conditions.

Testing:

The indoor unit shall be tested to measure air quantity and coil performance by measuring temperature difference, and then calculating the capacity.

4. **Refrigerant Piping:**

4.1 The condensing unit and evaporator unit shall be interconnected by type `L' seamless copper refrigerant liquid and suction lines using flared or brazed fittings. Necessary accessories shall be incorporated in the circuit.

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

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

After the refrigerant piping installation has been completed the refrigerant piping system shall be pressure tested using, Freon mixed with nitrogen at a pressure of 20 Kg per Sq. cm. (High side) and 10 Kg per Sq. cm (Low side) pressure shall be maintained on the system for a minimum of 12 hours. The system shall then be evacuated to a minimum vacuum of 70 cm. of mercury and held for 24 hours, during which time change in vacuum shall not exceed 12 cm of mercury. Vacuum shall be checked with vacuum gauge.
All refrigerant piping shall be installed strictly as per the instructions and recommendations of air conditioning equipment manufacturers.

5. **Miscellaneous:**

5.1 The unit shall have control panel, housing the starting switches, contactor, relays etc.

5.2 Isolation pads shall be provided under the units.

5.3 Drain line shall be provided from fan coil unit upto drain trap. (To be priced separately).

5.4 Ductable unit shall have canvass connection at its outlet. The canvass connection shall be fire retardant, nonporous double layer.

5.5 Suitable M.S. angle iron supporting frame shall be provided for the condensing unit and supporting arrangement for the indoor units.

5.6 Interconnecting power and control cabling shall be provided between condensing unit and evaporator unit.

6. **Power Supply:**

Power supply near the indoor unit will be provided by the Electrical sub-contractor with suitable MCBs.

From MCB to indoor unit and outdoor unit to Indoor unit by the contractor along with earthing.

III VENTILATION SYSTEM

1. **General:**

The ventilation fans shall be complete in all respects and shall generally comply with the following specifications given below:

2. **Exhaust Fans (Propeller Type):**

2.1 The exhaust fans shall be propeller type with steel hub and M.S. blade, mounted directly on the shaft of a totally enclosed motor.

2.2 The fan blades shall be of pressed steel of aerofoil design for high efficiency and static pressure.

2.3 The mounting frame shall be of cast/sheet steel with steel brackets to connect the frame with the fan/motor assembly. Rubber mounts shall be provided between the mounting frame and the mounting brackers.

2.4 The fan motor shall be to totally enclosed squirrel cage type.

2.5 Fan shall be with gravity louvers.

3. **Inline Fans**

3.1 **Inline Fans:**

The fan shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators.

3.1.1 **Housing**

The housing shall be constructed of hot rolled GSS sheet metal construction. Housing metal parts shall be either spot welded or screwed or mounted together with Rivets. The housing shall indicate arrow showing rotation, make, model and duty conditions.

3.1.2 **Fan Wheel**

Fan wheel shall be forward/backward curved type, fan wheel shall be statically and dynamically balanced.

3.1.3 **Ball Bearing**

The ball bearing shall be completely maintenance free and can be used in any mounting position, at maximum indicated temperature. The bearing lubricant shall be suitable for a minimum ambient temperature of minus 15^0 C. For application at maximum indicated ambient temperature, life expectancy L_{10} is 40,000 hours minimum.

3.1.4 **Fan Motor**

Fan shall be supplied with built in Thermal contact (TK). At the critical high temperature

point (`B' = 130 C or `F' = 155^0 C) the Thermal contact will open and break the power supply to the fan. Fan motor shall have insulation class `B' or class `F' and protection class IP44 or IP54.

3.1.5 **Fan Drive**

The fan shall be direct driven type.

4. **Painting:**

The complete fan assembly, casing and other steel structure shall either be GSS or epoxy panted as per IS 5: 1994 specification for ready mixed paints and enamels.

IV CONTROL PANEL, MOTORS AND SWITCHGEARS

1. **General**

1.1 The motor and switchgears required for various items shall generally be as per specifications given below. All electric motors shall be suitable for 3 phase, 50 Hz, 415 + 10% - 15% Volts A.C. supply.

2. **L.T. Electric Panel Boards**

2.1 The main L.T. Panel board shall be extendible type on both sides, having in it all switches, starters & accessories and shall be completely factory prewired. It shall be suitable for voltage systems upto 500 volts, 3 phase, 50 Hz, 4 wire supply capable of functioning satisfactorily in temperatures of 45^{0}C and rupturing capacity not below 31 MVA at 415 Volts.

2.2 The boards shall be fabricated from 2.0 mm thick, cold rolled M.S. Sheets. The front opening door panels shall be from 2 mm thick, cold rolled M.S. Sheets. Suitable stiffeners shall be used in fabrication the housing. All steel members shall first be degreased, then descaled using dilute sulphuric acid and a suitable phosphating process then the boards shall be given 2 coats of red oxide primer with powder coated finish in siemens grey color. The switch board shall be dust proof and vermin proof. The panel shall generally conform to IS 8623 (full conformity not called for). It shall be flush in front and back. The panel shall have front and rear access.

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

2.4 Items such as ammeters, switches etc. shall be located close to the corresponding switchgear and otherwise all items shall be arranged in a neat symmetrical pattern.

2.5 The doors of the switch compartments and cable access shall be hinged type and that of busbars shall be fixed type.

2.6 The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.

2.7 All panel doors shall have synthetic rubber gaskets with good ageing, compression and resistance characteristics.

2.8 All the breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in OFF position.

2.9 Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch OFF the unit.

2.10 All the units pertaining to a motor shall be incorporated in one cabin i.e switch, starter, CTS ammeter, current operated MPRD-2 single phasing preventor, indicating lamps etc.

2.11 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enameled white on both sides and with inscriptions in signal red color on front side shall be provided on the panel board.

2.12 Every starter/contactor etc. shall be controlled by an isolating device of adequate rating as listed later.

2.13 A voltmeter and ammeter shall be provided to indicate incoming voltage and along with rotary phase selection switches.

2.14 Ammeters shall be provided for incoming current to all motors of 10 HP (7.5 KW) and higher ratings.

2.14.1 Ammeters for all the motors upto 50 HP (37.5 KW) shall be direct reading type.

2.14.2 Ammeters for motors of 50 HP (37.5 KW) and above shall be operated with a selector switch.

2.15 LED type indicating lamps in approved colors shall be provided for the 3 phases and for status of all controlled devices.

2.16 All the switchgear shall be earthed to the earth bus.

2.17 Earth shall be extended for each compartment to the door by means if a flexible, insulated copper conductor with crimped legs on either side.

2.17.1 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.

2.17.2 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

2.18 Etched plastic name plates shall be provided for all the incoming, outgoing switchgears, ammeter, voltmeter etc.

2.19 All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper color code.

2.20 The power wiring from the circuit/air breakers to the starters shall be carried out using color coded, PVC insulated copper conductors crimped with lugs.

2.21 The outgoing wires of starters shall also be pvc insulated color coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

Important Note

All Panel fabrication drawings shall be got approved, before the start of the fabrication work.

3. **Bus Bars**

3.1 The Bus Bar shall be mounted in a separate compartment in the Panel Board.

3.2 The Bus Bars and interconnections shall be of aluminum strips unless otherwise specified.

3.3 The Bus Bar shall have rectangular cross - section of (1) mm^2 per Amp. rating for full load current in the 3 phases as well as for neutral and should be extendable, if mounted horizontally.

3.4 The Bus Bars shall be insulated with heat shrink sleeves and color coated. They should be supported on supports made of glass fiber reinforced thermosetting compound at regular intervals sufficient to withstand the force of any short circuit.

4. **Circuit Breakers**

The panel and the bus bars plus outgoing of all devices shall be protected by different types of circuit breakers as described below and conforming to specification as given later on:

S.No.	Type	Upto 40 Amp.	63 A	80 to 200 A	Above 200 to 400 A	Above 630 A
1.	Incoming	MCB	MCCB	MCCB	MCCB	ACB
2.	Outgoing	MCB	MCB	MCCB	MCCB	ACB

4.1 **Air Circuit Breaker (ACB)**

4.1.1 The air Circuit Breakers shall be Draw out type conforming to I.S: 13947 (Part 2) 1993.

4.1.2 The ACB shall be complete with solid state overload, short circuit and earth fault protection with adjustable settings.

4.1.3 Each ACB shall have 4 'NO' and 4 'NC' potential free auxiliary contacts, in addition to those required for its internal operating mechanisms.

4.1.4 There shall be suitable indicators for OPEN/CLOSE/SERVICE/TEST and Spring charged positions.

4.1.5 It shall be possible to close the door in Test position.

4.1.6 Castle Key and/or other interlocking devices shall be provided as required.

4.2 **Molded Case Circuit Breakers (MCCB)**

4.2.1 The MCCB shall have TP + NL and be suitable for simultaneous manual opening and closing with rotary operating handle.

4.2.2 The ON/OFF/TRIP positions shall be clearly marked and easily visible to an operator and confirm to latest IS: 13947-1993.

4.2.3 There shall be fixed/adjustable tripping devices with inverse time characteristics for overload and short circuit protection.

4.2.4 Suitable Interlocking mechanism shall be provided, where required.

4.3 **Miniature Circuit Breakers (MCB)**

4.3.1 The MCB shall have quick make/break contacts with a heat-resistant housing, having high Impact strength and confirm to IS 8828-1996.

4.3.2 The contacts shall be of silver nickel alloy.

4.3.3 The MCB shall permit over load for short duration, as required for Inductive loads and the breaking capacity shall not be less than 10 KV at 415 Volt A.C.

4.3.4 It shall be equipped with overload and short circuit protection devices and shall be suitable for DIN mounting.

4.4 **Isolator Switches**

4.4.1 Isolator switches are to be provided for equipment located outdoors or for those located in separate enclosure, other than those Nos. having the Electric Panel.

4.4.2 The Isolator Switch should be of Rotary Load Break type with a weather proof sheet steel enclosure. Its rating shall be same as the outgoing device in the Electric Panel.

5. **Contactors**

All non inductive loads shall be provided with suitable sized magnetic contactors.

5.1 The contactors shall have 3/4 poles plus a minimum 2 'NO' and 2 'NC' contacts. All contacts shall be of solid silver.

5.2 The No volt coil shall generally be suitable for 220 Volts + 10%, - 15% (wide band type) A.C. supply except when specified or required otherwise.

6. **Starters**

6.1 The type of starters to be provided for the motors shall be as follows:

6.1.1 Squirrel Cage motors : upto 7.5 HP (5.6 KW) Direct on Line Type

6.1.2 Squirrel Cage motors : Above 7.5 HP (5.6 KW) Automatic Star Delta Type

6.1.3 Compressor motor : Above 300 HP (225 KW) Automatic Auto Transformers (where specified)

6.1.4 All starters shall have auxiliary contacts for interlocking different machines, connecting indicating lights, controls, alarms, etc.

6.1.5 All starters shall be provided with separate single phasing preventors.

6.2 **Direct On-Line Starters**

6.2.1 These starters shall have heavy duty air brake contactors of suitable rating.

6.2.2 These starters shall be complete with adjustable overload relays on all three phases, single phase preventing device and under voltage release. The starters should be "hand reset" type.

6.2.3 The "No Volt Coil "of these starters shall be 220 Volts + 10% - 15% (wide band type) whenever any controls on safety devices are connected in the starter's circuits, otherwise standard 415 volts coils may be used. There shall be ON-OFF push button for each starter unless remote operation of the starter is required.

6.3 **Automatic Star Delta Starters**

6.3.1 These starters shall have heavy duty air brake contactors of suitable ratings along with an adjustable timer to automatically switch the motor connections from star to delta connections.

6.3.2 Each starter shall be complete with adjustable overload relays on all three phases and under voltage release. The starters should be "hand reset" type.

6.3.3 The "No Volt Coil" shall be of 220 Volts + 10% - 15% (wide band type) rating wherever any controls of safety device are connected in the starter circuit, otherwise standing 415 volts coils may be used. There shall be ON-OFF push button for each starter unless remote operation of the starter is required.

6.4 **Automatic Auto -Transformer Starter**

6.4.1 These starters will be oil immersed, each one fixed on a separate panel.

6.4.2 Necessary devices shall be provided for the automatic tap setting of the starter.

6.4.3 The starter should have "No Volt Coil" wide band type circuit of 220 volts to be connected to control circuits.

6.5 The Motor starter shall be in accordance with IS 1882. The starter shall be totally enclosed metal clad, dust and vermin proof construction. The starter shall be of continues rating.

6.6 Contactors shall have the number of poles as required for appropriate duty. The making capacity of the starters shall be as per AC 23 of ISS.

7. Panel Accessories

7.1 All Voltmeters and Ammeters as specified shall be square of 96 mm x 96 mm, flush mounting type.

7.2 The Indicating Lamps shall be of LED type with Low Watt Power. The Lamps shall have translucent covers of following colors.

7.2.1 Red/Yellow/Blue for phase light.

7.2.2 Green/Amber for ON/OFF indication.

7.2.3 Concealed door lock.

8. Subsidiary Panels (With Single Switch)

8.1 Subsidiary panels shall be provided for equipment located away from the plant room, such as air handling units, blower etc.

8.2 The construction of these panel should be similar to the main panel and shall have all related accessories, except when specified.

8.3 The sub panel shall be wall hung type and as compact as possible.

8.4 Panel fabrication drawings shall be got approved before fabrication.

9. Squirrel Cage Motors

9.1 The squirrel cage motors shall be either screen protected or totally enclosed fan cooled, depending on the application and as stated in “schedule of equipment”. All motors shall conform to IS 325/1978, IS: 1231 for foot mounted motors and IS:2223 for flange mounted motors.

9.2 The stator windings shall be with class ‘B’ insulation.

9.3 Motors shall be provided with ball/ roller bearings. Bearings shall have ample capacity to deal with any axial thrust. Suitable grease nipple shall be provided for regreasing the bearings.

9.4 Motors shall be provided with a cable box for terminating the PVC insulated, PVC sheathed armored aluminum cables.

10. Installation of Motor

10.1 Installation of the motor shall be in accordance with IS-900.

10.2 The motor along with its driven machine or equipment shall be provided with vibration isolation arrangement motors shall generally be provided with slide rails fixed to the

base units nuts and bolts to facilitate belt installation and subsequent belt tension.

10.3 Motors shall be wired as per the detailed specifications and drawings all the motor frame shall be earthed with 2 Nos. of earthing conductors.

10.4 Motors shall be tested at works in accordance with the relevant Indian standard specifications and test certificates shall be furnished in triplicate.

Note: Rubber mats of 1100 volts capacity shall be laid in front of panel as per site requirement and no extra shall be paid.

11. **Painting**

All sheet steel work shall undergo a multi tank process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then sprayed with a high corrosion resistant primer. The primer shall be baked in oven. The finishing treatment shall be by application of powder coated paint of approved shade and stoved.

V DUCT WORK AND OUTLET (FACTORY FABRICATED)

1. **Scope:**

The scope of this section comprises supply fabrication, installation and testing if all sheet metal / aluminum ducts.

2. **Governing Standards:**

Unless otherwise specifications here, the construction, testing and performance of the ducting system shall conform to the SMACNA-1995 standards ("HVAC Duct Construction Standard – Metal and Flexible – Second Edition 1995" – SMACNA)

3. **Raw Material:**

3.1 **Ducting:**

3.1.1 All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I. raw material furnished with accompanying Mill Test Certification.

3.1.2 Galvanizing shall be of 120 gms/sqm (total coating on both sides)

3.1.3 In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for t5hickness and zinc coating at contractor's expense

3.1.4 The G.I. raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross-section dimensions.

3.2 **Duct Connectors and Accessories:**

3.2.1 All transverse duct connectors (flanges/cleats) and accessories/related hardware are

such as support system shall be zinc-coated(galvanized)

4. **Fabrication Standards:**

All ductwork including straight sections, tapers, elbows, branches, showpieces, colors, terminal boxes and other transformation pieces must factory-fabricated or by equivalent technology. Equivalency will require fabrication by utilizing the following machines and processes to processes to provide the requisite quality of ducts and speed of supply.

4.1 Coil lines to ensure location of longitudinal seams at comers / folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along with any face side of the duct.

4.2 All ducts, transformation pieces and fittings to be made on CNC profile cutters for required accuracy of dimensions.

4.3 All edges to be machine treated using lock formers, flangers and roller for turning up edges.

4.4 Sealant dispensing equipment for applying built in sealant in Pittsburgh lock where sealing of longitudinal joints are specified.

5. **Selection of G.I. Gauge and Transverse Connector:**

5.1 Duct construction shall be in compliance with 1" (250 pa) w.g. static norms as per SMACNA.

5.2 All transverse connectors shall be the 4-bolt slip-on flange system or 4 bolt system with TDC flange or equivalent imported makes of similar 4-bolt system with built in sealant.

5.3 The specific class of transverse connectors and duct gauges for a given duct dimensions will be as per table 1 below for the 1" (250 pa) pressure class.

5.4 Non-toxic, AC –applications grade P.E. or P.V.C Gasketing is required between all running flange joints. Gasket sizes should confirm to flange manufacturer's specifications.

Table 1:

For selection of flange class and duct gauges at 1200 mm spacing						
Duct Dimension	Duct pressure in inches					
	1"(250)*5	**2"(500)**	**3"(750)**	**4"(1000)**	**6"(1500)*4**	**10"(2500)**
In mm	Reinforcement Class – Duct Gauge					
Upto 250	***3E-26**	**E-26**	**E-26**	**E-26**	**E-26**	**E-24**
251 – 300	**E-26**	**E-26**	**E-26**	**E-26**	**E-24**	**E-24**
301 – 350	**E-26**	**E-26**	**E-26**	**E-26**	**E-24**	**E-22**
351 – 400	**E-26**	**E-26**	**E-26**	**E-26**	**E-24**	**E-22**

401 - 450	**E-26**	**E-26**	**E-26**	**E-26**	**E-24**	**H-20**
451 – 500	**E-26**	**E-26**	**E-24**	**E-24**	**E-24**	**H-20**
501 – 550	**E-26**	**E-26**	**E-24**	**E-24**	**H-24**	**H-20**
551 – 600	**E-26**	**E-26**	**E-24**	**E-24**	**H-22**	**H-20**
601 – 650	**E-26**	**E-26**	**E-24**	**E-24**	**H-22**	**H-20**
651 – 700*2	**E-26**	**E-26**	**E-24**	**H-24**	**H-22**	**H-18**
701 – 750	**E-26**	**E-26**	**E-24**	**H-24**	**H-22**	**J-18**
751- 900	**E-26**	**E-24**	**E-24**	**H-22**	**H-20**	**J-18**
901 – 1000	**E-26**	**H-24**	**H-22**	**H-20**	**J-18**	**J-16**
1001 – 1200	**E-24**	**H-22**	**H-20**	**J-18**	**J-18**	
1201 – 1300	***3H-24**	**H-20**	**J-18**	**J-18**	**J-16**	
1301 – 1500	**H-24**	**H-18**	**J-18**	**J-16**		
1501 – 1800	**H-22**	**J-18**	**J-16**			
1801 - 2100	***3J-20**	***3J-20**				
2101 – 2400	**J-18**	**J-18**				
2401 - 2700	**J-18**					

Notes:

***1-** SMACNA- Sheet Metal and Air Conditioning Contractor's Association Inc- "HVAC Duct Construction Standards- Metal and Flexible" – 1995 U.S.A

*2- **Reading Guide-** for duct size between, say 651m and 700mm, when the pressure class is 1" w.g. static we require a "E" class flange and duct gauge of 26. For the same size range but with static pressure at 4" w.g. a 'h' Class flange with duct gauge of 24 should be used

*3- The flange classes available are designated e, hand j. For E and H class of flange use gasket size 10 mm wide and 45 mm thick. For J Class use 15 mm wide and 6 mm thick gasket.

*4- For pressure Class 6" w.g. static and above contact manufacture to confirm the gasket type & size.

*5- (Not Applicable for current Specifications) For non-critical comfort cooling applications (1" w.g. pressure class) optional "C & S" or "C & SS" cleat joints can be used.

Upto 450 mm duct size use" C & S" Cleats
415 to 750 m duct size use "C & SS" Cleats

Over 750 mm duct size use flanges as specified or as per manufacturer's standard.

All higher-class flange can always be substituted for a lower class (e.g. class "J" for class "H". class "H" for Class "E")

The TDC flange classes remain same in all sizes, use gasket size 12 mm wide and 4 mm thick in all sizes.

6. Duct Construction:

6.1 The fabricated duct dimensions should be as per approved drawings and al connecting sections are dimensionally matched to avoid any gaps.

6.2 Dimensional Tolerance: Al fabricated dimensions will be within +/- 1.0 mm of specified dimensions. To obtain required perpendicularity. Permissible diagonal tolerance shall be +/- 1.0 mm per meter.

6.3 Each and every duct pieces should be identified by colour coded sticker which shows specific part numbers, job name, drawing number, duct size and gauge.

6.4 Duct shall be straight and smooth and the inside. Longitudinal seams shall be airtight and at comers only which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice, to ensure air tightness.

6.5 Change in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitter shall be installed in all bends and duct colors designed to permit the air to make the turn without appreciable turbulence.

6.6 Plenums shall be shop/factory fabricated panel type and assembled at sight.

6.7 The deflection of transverse joints should be within specified limit for rectangular duct deflection as given in SMACNA. Page No, 7.6

6.8 Reinforcement of duct shall be achieved by either cross breaking a straight beading depending on length of ducts.

As per SMACNA Page No.1.74, fig 1-8
"Duct Size 19" (483 mm) wide and larger which have more than 10sqft of unbraced panel shall be beaded or cross broken unless duct will have insulation covering or acoustical liner. This requirement is applicable to 20 g (1.00 mm) or less and 3" w.g (750 pa) pressure or less. Duct for 4" w.g. (1000 pa) or more do not require beads or cross-breaks".

7. Support System:

7.1 A completely galvanized system consisting of fully threaded rods, slotted angles or double L bottom brackets (made out of 3.0 mm M.S. sheet) nuts, washer and anchor bolts confirming to SMACNA standards should be used.

Sr. No.	Maximum Duct Size(mm)	Hanger Road Diameter	Interval (mm)
1.	Up to 700	6mm	2400

2.	701 – 1200	8 mm	2400
3.	1201 – 2000	10 mm	2400
4.	Above 2000	12 mm	2400

7.2 As an alternative, slotted galvanized brackets attached to the top two bolts of the system may also be used as appropriate for the site condition.

7.3 To provide the required thermal brake effect, Neoprene or equivalent material of suitable thickness shall be used between duct support and duct profiles in all supply air duct does not enclose by return air plenums.

8. Installation:

8.1 Tools and tackles for site work

The duct installation shall confirm to SMACNA norms. For duct assembly and installation, the use of suitable tools and tackles should be used to give the required duct quality and speed of installation including (but not restricted to)

a) Electric Pittsburgh seamer - used for closing Pittsburgh joints
b) Electric Slitting Shear - to make cut – outs
c) Drilling machine and drill bitts - for drilling holes sheet metal work
d) Hammer drill machine with drill bits - for drilling holes in building structure for anchor
e) Hoisting system - for lifting the duct assembly up to mounting heights

8.2 Installation Practice

All ducts shall be installed as per tender drawings and in strict accordance with approved shop drawing to be prepared by the Contractor

8.2.1 Thew contractor shall provide any neatly erect sheet metal work as may be required to carry out the intent of these specifications and drawings. The work shall meet with the approval of owner's site representative in all its parts and details.

8.2.2 All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the building whether or not the same are shown on the drawings. Where there id interference /fouling with other beams, structural work, plumbing and conduits, the ducts shall be suitably modified as per actual site conditions.

8.2.3 Ducting over false ceiling shall be supported from the slab above, or from beam, in no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. Al metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractor's work in the building.

8.2.4 Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick appropriate insulation around the duct and totally covered with fire barrier mortar

for complete sealing.

8.2.5 All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blowers coil unit that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge.

9. **Documentation & Measurement for Ducting:**

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

9.2 Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

9.3 All duct pieces to have a part number, which should correspond to the serial number assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement, verification and approvals.

10. **Testing:**

After duct installation, a part of duct section (approximately 5% of total ductwork) may be selected at random and tested for leakage. The procedure for leak testing should be followed as per SMACNA – "HVAC Air Duct Leakage Test Manual" (First Edition)

11. **Dampers:**

11.1 At the junction of each branch duct with main duct and split of main duct, volume control dampers must be provided. Dampers shall be two gauges heavier than the gauge of the large duct and shall be rigid in construction.

11.2 The volume control dampers shall be of an approved type; lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions. Dampers shall be provided with suitable links levers and quadrants as required for their proper operation.

11.3 The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm. Angles shall not interfere with the operation of dampers, nor cause any turbulence.

11.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings. Dampers and frames shall be constructed of 1.6 mm steel sheets and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh.

11.5 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.

11.6 After completion of the duct work, dampers are to be adjusted and set to deliver air flow as specified on the drawings.

12. **Heating / Cooling Thermally Powered VAV Diffuser / Grille:**

12. Each diffuser shall be thermally powered to infinitely vary the supply of air into space, in either heating or cooling mode, by means of regulating a variable aperture damper, known as a control disc, vertically within the diffuser. Supply air from the variable geometry diffusers will discharge horizontally in a 360^0 pattern and will maintain constant air movement in the space throughout the range of volume variation from 100% down to 25%.

12.2 The thermal room sensing element shall be location behind an induction cap in the center of the diffuser panel and shall provide no more than 1^0 F thermal deadband between induced temperature and zone temperature.

12.3 Each diffuser shall be individually adjustable to sense room temperature within the space between 68^0 F and within 77^0 F. Each diffuser shall be individually adjustable for minimum airflow from 0 to 30%. Each diffuser is to be fitted with a single thermally supply air sensing element to automatically change from and to a cooling and heating mode and be able to infinitely vary the supply of air into the space in either mode. Each diffuser shall be self – contained and require no external power source to maintain space temperature throughout the range of operation. The diffusers shall carry the manufacture's
10-year warranty.

12.4 Ceiling diffuser shall be square, architectural, panel face diffusers. The diffuser shall have an 18-gauge steel face panel mounted on an aerodynamically shaped, one piece, seamless back pan. The diffuser face panel must be field removable by means of four positive locking clips. The exposed surface of the face panel shall be smooth, flat and free of visible fasteners. The face panel cannot project more than 1/8 inch below the outside border of the diffuser back pan.

12.5 The face panel shall have an aerodynamically shaped, hemmed edge. A single Metal thickness on the edge of the face panel is not acceptable. Ceiling diffusers with a 24 x 24-inch full face shall have no less than an 18 x 18-inch face panel. The entire diffuser shall be constructed of steel, with an integral drawn inlet. The diffuser neck shall have a minimum $1^{1/8}$ –inch depth available for duct connection.

12.6 Finish shall be thermoset alky-melamine enamel paint, baked at 315^0 F. The paint hardness must be 2H to 3H. The paint passes a 300-hour ASTM D 1654 corrosive Environment Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass the 500-hour ASTM D870 water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact cracking Test with 50-inch pound applied.

12.7 Alternatives to the specified product must provide published performance ratings that meet or exceed the performance of the T_3 SQ ceiling diffuser. All test data shall be obtained in accordance with ANSI/ ASHRAE Standard 70-1991, and ARI Standard 880-98. A copy of the certified test results shall be provided upon request. The VAV diffuser

shall be ARI certified.

13. **Fire & Smoke Dampers**

Combination Fire Smoke Damper –

13.1 Combination Fire Smoke Dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules. Dampers shall meet the requirements of the latest edition of NFPA 90A, 92A, and 92B.

13.2 **Dampers shall be tested, rated and labeled in accordance with the latest edition of UL Standards 555 and 555S**. Dampers shall have a UL555 fire rating of 1 1/2 hours. Each damper shall be equipped with a heat responsive device which has been tested and approved for use with the damper assembly in accordance with UL555. The heat responsive device shall have a temperature rating of (specifier select one of the following) 74 C or 100 C. Dampers shall be UL labeled for use in dynamic systems. The damper shall have a dynamic closure airflow rating equal to or greater than the airflow at the damper's installed location and a dynamic closure pressure rating of 101.6 mm H2O.

13.3 Dampers shall have a UL555S Leakage rating of Class I and a Temperature rating of 177 C. Dampers shall have a UL555S operational airflow rating equal to or greater than the airflow at its installed location and an operational pressure rating of 101.6 mm H2O. Damper actuators shall be factory mounted and qualified for use with the damper in accordance with UL555S. Damper actuators shall be electric type for 220 /24 volt operation. Actuator shall be of Honeywell or Belimo make.

13.4 All UL555 and 555S Dynamic Closure Ratings, Operational Ratings and Leakage Ratings shall be qualified for airflow and pressure in either direction through the damper. UL ratings shall allow for mounting damper vertically (with blades running horizontal) or horizontally.

13.5 The Damper Manufacturer's submittal data shall certify all air performance pressure drop data is licensed in accordance with the AMCA Certified Ratings Program. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

13.6 Damper blades shall be 1.6 mm galvanized steel 3 Vee type with three longitudinal grooves for reinforcement. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 13 mm are unacceptable).

13.7 Damper frames shall be galvanized steel formed into a structural hat channel shape with reinforced corners. Bearings shall be sintered bronze sleeve type rotating in extruded holes in the damper frame. Jamb seals shall be stainless steel compression type.

14. **Actuators**

The actuator used shall be maintenance free direct coupled spring return suitable to work on 24 V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/close the damper. The selection of actuator size shall

be the responsibility of the manufacture of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature other features of the damper actuator shall be as under.

a) It have tamper proof housing with IP-54 protection rating.

b) Shall have mechanical integrity of at least one hour at 900^0 C.

c) Shall have minimum 60000 safe position at rated torque. It shall be capable of withstanding a temperature of 75^0 C for 24 Hrs.

d) Shall have electronic overload or digital sensing circuit to prevent damage to actuator.

e) Should be capable of changing direction of rotation by changing mounting orientation.

f) Shall have manual override facility.

15. **Control Panel**

The control panel shall be supplied by damper manufacturer fitted on damper compatible with damper actuators. The control panel shall have at least following features.

i. Power on indicating lamps with 230 V/24 V transformer.
ii. Damper close & open indication.
iii. Reset push button.
iv. Push button for manual running of actuator for periodic inspection.
v. Auxiliary contacts 24 V & 230 V.
vi. Contact points to receive signal from smoke defector/fire alarm panel.

The control panel shall receive 230 V A/C supply & interconnecting wiring between control panel & actuator shall be done using fireproof cables.

Access door will be provided in the duct before each fire damper.

16. **Access panel:**

16.1 A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

17. **Miscellaneous:**

17.1 All duct work joints are to be true right angle and with all sharp edges removed.

17.2 Sponge rubber gaskets also to be provided behind the flange of all grilles.

17.3 Each shoot from the duct, leading to a grille, shall be provided with an air deflector to

divert the air into the grille through the shoot.

17.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.

17.5 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by owner/owner engineer.

17.6 The ducts should be routed directly with a minimum of directional change.

17.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the owner/owner engineer, at no extra cost.

17.8 All angle iron flanges to be welded electrically and holes to be drilled.

17.9 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centers.

17.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.

17.11 The G.S.S. Ducts should be lapped 6 mm across the flanges.

17.12 The ducts should be supported by approved type supports at a distance not exceeding 2.4 meters.

18. **Standard Grilles:**

18.1 The supply and return air grilles shall be fabricated from extruded Aluminum sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of Aluminum extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers. The grilles may or may not be with an outer frame.

18.2 The damper blades shall also be of extruded Aluminum sections. The grill flange shall be fabricated out of Aluminum extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

19. **Diffusers/Slot Diffusers:**

19.1 The ceiling type square diffusers shall be of Aluminum extruded sections with flush or stepdown face, as specified with fixed pattern and neck.

19.2 All supply diffusers shall be provided with extruded Aluminum dampers, with arrangement for adjustment from the bottom.

19.3 The slot diffusers shall be of Aluminum extruded sections with diffusion plate and sliding damper.

20. **Linear Diffusers/Grilles:**

20.1 The linear diffusers/grilles shall be fabricated from Aluminum extruded sections.

20.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.

20.3 The frame shall be of Aluminum extruded section and shall hold the louvers tightly in fixed position.

20.4 The dampers as described under grilles shall be provided wherever specified.

21. **Painting:**

21.1 All grilles, and diffusers shall be powder coated, before installation, in approved colour.

21.2 All ducts immediately behind the grilles/diffusers etc. are to be given two coats of black paint in matt finish.

22. **Testing:**

22.1 After completion, all duct system shall be tested for air leakage.

22.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final tabulation of air quantity through each outlet shall be submitted to the owner/owner engineer consultant for approval.

22.3 All sample required to approved by the client.

VI PIPING (VRV/VRF & SPLIT SYSTEM)

1. **GENERAL**

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder: -

2. **PIPING**

2.1 **Drain Piping:**

2.1.1 The drain piping shall be UPVC.

2.1.2 The fittings shall be of `R' brand of equal forged with screwed connections.

2.1.3 The gate valves shall be of gun metal as described earlier.

2.1.4 Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.

2.1.5 The drain line shall be provided upto the nearest drain trap and pitched towards the trap.

2.1.6 Drain lines shall be provided at all the lowest points in the system, as well as at equipment, where leakage of water is likely to occur, or to remove condensate and water from pump glands.

2.1.7 The drain pipe shall be insulated with two layers of nitrile rubber insulation.

2.1.8 Maximum pressure shall be 6 kgf.

2.2 **Copper Piping:**

2.2.1 Seamless soft copper tubing, type L shall be used to make connections to equipment, wherever required or specified.

2.2.2 Flare fittings e.g. flare nuts, tees, elbows, reducers etc. shall all be of brass.

2.3 **Refrigerant Piping:**

All refrigerant piping for the air conditioning system shall be constructed from soft seamless upto 19.1mm and hard drawn copper refrigerant pipes for above 19.1mm with copper fittings and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. Before joining any copper pipe or fittings, its 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 20Kg per sq.cm and 10 Kg per sq.cm (low side). Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum if 700mm 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)	**Wall Thickness in mm**
a) 54.1	1.5
b) 41.3	1.3
b) 34.9	1.3
c) 28.6	1.2

d)	25.4	1.2
e)	22.2	1.0
f)	19.1	1.0
g)	15.9	1.0
h)	12.7	0.8
i)	9.5	0.8
j)	6.4	0.8

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.

3. **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 /13 mm thick `O' Class elastomeric nitrile rubber as specified in BOQ.

VII INSULATION

1. **General:**

The Insulation of water piping, ducting, etc., shall be carried out as per specifications given below:

2. **Materials:**

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere.

2.1 **Duct Insulation and Drain Pipe:**

The insulation for drain piping, and duct shall be carried out from closed cell electrometric nitrile rubber having a `K' value of 0.034 W/ (M.K) at mean temperature of 10^{O} C. and a density of not less than 40 kgs/cubm. Water vapor permeability 4000 U and above. Fire rating class I/O as per British standard BS 476 part VII/- - 1997 building regulation. Approval of sample to be obtained in writing prior to execution.

2.2 **Other Insulation:**

2.2.1 The material for acoustic treatment of ducts, rooms, roofs etc. shall be resin bonded fiber glass, as described earlier, conforming to I.S. 8183 of 1976. The density of fiber glass shall be 32 kg/cub.m and the material shall be in the form of rolls of uniform density. The `k' value at 10^{o} C. shall not be less than 0.028 kcal/mhr/^{o} C. Wherever insulation is to be carried out inside the duct, fiber tissue is to be installed and contractor to ensure that no fibers of insulation material get mixed up with supply/return air.

3. **Drain Piping:**

3.1 Insulation of drain piping shall be carried out using 6 mm thick insulation tube of closed cell electrometric nitrile rubber having a `K' value of 0.034 W/(M.K.) at mean temperature of 10^{0} C and a density of not less than 40 kg/cubm.

3.2 **Installation**

3.2.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.

3.2.2 Cut insulation tube longitudinally and put on pipe and sealed the joints with adhesive and Aluminum tape (as approved by manufacturer).

4. **Refrigerant Piping:**

4.1 The suction line of refrigerant piping shall be insulated with 13 mm thick insulation as specified for chilled water pipe lines.

5. **Ducting:**

5.1 The ducts shall be insulated with the insulation sheets as follows.

5.2 Duct insulation thickness shall be as follows:

Duct in conditioned space - 6 mm thick

Duct in unconditioned space - 9 mm thick

Duct with treated fresh air - 9 mm thick

6. **Acoustic Lining:**

6.1 The acoustic lining shall consist of 25/50 mm resin bonded glass wool of density 32 KG/CUB.M (min) then it shall be covered by 0.5 mm perforated aluminum sheets having 3 mm perforation at 6 mm centers.

6.2 **Insulation**

6.2.1 The duct surface shall first be cleaned from inside.

6.2.2 Then the insulation shall be fixed inside the duct.

6.2.3 The insulation shall be covered with RP tissue.

6.2.4 The insulation shall then be covered with 0.5 mm perforated aluminum sheets.

6.2.5 The sheet and the insulation shall be secured to the duct by means of cadmium plated bolts, nuts and washers. The ends should be completely sealed off, so that no insulation material is exposed.

VIII ELECTRIC WIRING

1. **General:**

The electric wiring of motors for compressors, pumps, air handling units etc. As well as controls, heaters etc. and earthing of all equipment shall be carried out as per specifications given hereunder.

2. **Wiring for Motors, Heaters etc:**

2.1 The wiring for above equipment shall be carried out in conduits or using PVC armored cables.

2.2 The PVC armored power cable for use on 415 volts system shall be 3 or 3.5 core with aluminum conductors and be of 1100 volts grade, as per IS 1554 part I-1964. The cross section of the cable shall be to suit the load or rating of the equipment. The cable shall be aluminum conductor PVC insulated single wire/strip armored with overall PVC sheathing.

2.2.1 The cables shall be laid as per IS-1255/1967, Indian Standard Code of Practice.

2.2.2 The cables shall be laid, as per drawings or along a short and convenient route between switch board and the equipment, either in trenches, on wall or on hangers, supported from the slab. Cable routing shall be checked on the site to avoid interference with structure, equipment etc. Where more than one cables are running close to each other, proper spacing should be provided between them.

2.2.3 The radius of bends of the cable should not be less than 12 times the radius of cable to prevent undue stress and damage at the bends, the cables should be supported with wooden cleats fixed on M.S. Supports, when running in trenches, wall or ceiling suspended hangers. When laid underground the cables should be covered with fine soft earth and protected with cement concrete covering. Suitable G.I. Pipe shall be used wherever the cable comes out of the connected surface and clamped properly.

2.2.4 Wooden bushes shall be provided at the ends of pipes through which cables are taken in walls and floors.

2.2.4 All cables shall be terminated using suitable size cable glands and packing.

2.3 The wiring in conduits shall be 1100 volts grade.

2.3.1 The conduits used shall be of high quality, all joints shall be made with sockets. The bends and elbows shall have inspection covers fixed with grease free screws. The joints

shall be water tight. Approved metal saddles shall be used to secure the exposed conduits at a space of 1 meter or less. The connection of the conduit to switches etc., shall be secured by a check nut and ebonite bushes provided at the ends of conduits.

2.3.2 Flush inspection covers shall be provided in case of concealed, recessed conduits. The staples for the conduits shall not be spaced more than 0.60 meters apart. Before filling up the chase with concrete the conduits should be given a coat of rust proof paint.

2.3.3 The wires shall be drawn only after all the conduits have been properly fixed in position.

3. **Control Wiring:**

3.1 Control cables shall be 1100 volts grade as per IS 1554 made from copper conductor of 1.5/2.5 sq. mm PVC insulated single multi core unarmored with an overall PVC sheathing.

3.2 The cables and conduits wiring shall be carried out as per details given under 2.2 and 2.3 above.

4. **Earthing:**

4.1 All equipment connected with electric supply shall also be provided with double earthing continuity conductors. The size of copper earthing conductors shall be: -

Size of phase wire sq.mm Aluminum	size of copper conductor tape/wire (swg)
300	25 mm x 6 mm (strip)
185	20 mm x 3 mm (strip)
150	20 mm x 3 mm (strip)
120	12 mm x 3 mm (strip)
95	4 Swg
70	4 Swg
50	6 Swg
35	8 Swg
25-6	8 Swg
4	10 Swg

Note :- GSS earthing conductors of equivalent size may be used in lieu of copper earth mentioned above.

5. **Miscellaneous:**

5.1 The final connections to the equipment shall be through flexible connections in case of conduit wiring and also where the equipment is likely to be moved back and forth, such as on slide rails.

5.2 An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 meters away from the main panel.

5.3 Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.

5.4 The branch lines from the main panel to each equipment shall be separated and should not criss cross other lines.

5.5 The entire installation shall be tested as per electricity rules and I.S.S 732-1973 with amendments 1,2 & 3 prior to the commissioning of the plant and a suitable test report furnished by a competent and authorized person. The test report will be obtained by contractor himself at his own expenses.

5.6 All exposed switch board panels, conduits, hangers etc. shall be given 2 coats of suitable paint of approved color, when all work has been completed.

IX TESTING, BALANCING & COMMISSIONING

1. General:

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the CHC, in accordance with the provisions of the applicable ASHRAE standards or approved equal.

2. Compressors/Condensers/Evaporators etc.

Complete unit shall be factory tested for leaks.

Complete unit shall be factory tested for performance at rated conditions.

All controls shall be tested for proper functioning and set for design value.

3. Indoor Units:

3.1 Blowers

Dynamic/static balancing of impeller.

Performance test as per applicable codes.

3.2 Coils

Pneumatic test or as per manufacturer.

3.3 Instruments and Controls

Visual examination.

4. For Associates Works at Site:

Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

Pressure testing of pipe fit used for the refrigerant and water services.

Pressure testing, leak testing of complete piping network. Condenser for refrigerant/ services.

Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning system.

Checking of calibration of controls and instrumentation

Checking of assemblies for electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.

Inspection of complete electrical installation at site.

Installation of main equipment's like compressor, condenser, evaporator.

Performance testing of complete A.C. system as per specifications.

5. **Duct Work:**

All branches and outlets shall be tested for air quantity, and the total of the air quantities shall be within plus five percent (5%) of fan capacity.

Volume dampers shall be tested for proper operation.

6. **Balancing and Adjustment:**

Indoor unit, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities as indicated, at each outlet, on the drawings and shall be recorded and submitted to the CHC. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horse power, the CHC shall be notified before proceeding with the balancing of air distribution system.

7. **Electrical Equipment:**

All electrical equipment shall be cleaned and adjusted on site before application of power.

The following tests shall be carried out:

Wire and cable continuity tests.

Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 Volts meggar. The meggar reading shall be not less than one megohm.

Earth resistance between conduit system and earth must not exceed half (1/2) CMH.

Phasing out and phase rotation tests.

Operating tests on all protective relays to prove their correct operation before energizing the main equipment.

Operating tests on all MCB's.

8. **Performance Tests:**

The installation as a whole shall be balanced and tested upon completion, and all relevant information, including the following, shall be submitted to the engineer in charge.

Air volume passing through each unit, duct, grilles, apertures.

Differential pressure readings across each filter, fan and coil, and through each pump.

Static pressure in each air duct.

Electrical current readings, in amperes of full and average load running, and starting, together with name plate current of each electrical motor.

Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.

Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "on coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.

Any other readings shall be taken which may subsequently be specified by the Engineer-in-charge.

9. **Miscellaneous:**

The above tests are mentioned herein for general guidance and information only but not by way of limitation to the provisions of conditions of contract and specification.

The date of commencement of all tests listed above shall be subject to the approval of the Engineer and in accordance with the requirements of this specification.

The contractor shall supply the skilled staff and all necessary instruments and carry out any test of any kind on a piece of equipment, apparatus, part of system or on a complete system if the client requests such a test for determining specified or guaranteed data as given in the specification or on the drawings.

Any damage resulting from the tests shall be repaired and/or damaged material replaced, all the satisfaction of the Engineer.

In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommended after the adjustment or repairs have been completed.

The contractor must inform the Engineer when such tests are to be made, giving sufficient notice, in order that the Engineer or his nominated representative may be present.

Complete records of all tests must be kept and 3 copies of these and location drawings must be furnished to the Engineer.

The contractor may be required to repeat the test as required, should the ambient conditions at the time not given, in the opinion of the client, sufficient and suitable indication of the effect and performance of the installation as a whole or of any part, as required.

X MODE OF MEASUREMENTS

1. **Unit Prices in the Schedule of Quantities:**

1.1 The item description in the schedule of quantities is in the form of a condensed resume. The unit price shall be held to include everything necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.

1.2 The unit price of the various items shall include the following:

1.2.1 All equipment, machinery, apparatus and materials required as well as the cost of any tests which the consultant may request in addition to the tests generally required to prove quality and performance of equipment.

1.2.2 All the labour required to supply and install the complete installation in accordance with the specifications.

1.2.3 Use of any tools, equipment, machinery, lifting tackle, scaffolding, ladders etc. Required by the contractor to carry out his work.

1.2.4 All the necessary measures to prevent the transmission of vibration.

1.2.5 The necessary material to isolate equipment foundations from the building structure, wherever necessary.

1.2.6 Storage and insurance of all equipment apparatus and materials.

1.3 The contractor's unit price shall include all equipment, apparatus, material and labour indicated in the drawings and/or specifications in conjunction with the item in question, as well as all additional equipment, apparatus, material and labour usual and necessary to make in question on its own (and within the system as a whole) complete even though not specifically shown, described or otherwise referred to.

2. **Measurements of Sheet Metal Ducts, Grilles/Diffusers etc.**

2.1 **Sheet Metal Ducts**

2.1.1 All duct measurements shall be taken as per actual outer duct surface area including bends, tees, reducers, collars, vanes & other fittings. Gaskets, nuts, bolts, vibration rotation pads are included in the basic duct items of the BOQ.

2.1.2 The unit of measurements shall be the finished sheet metal surface area in meters squares. No extra shall be allowed for lapse and wastages.

2.1.3 All the guide vanes, deflectors in duct elbows, Branches, grille collars quadrant dampers etc. Shall be measured for actual sheet metal surface and paid for at the same rate as duct of same thickness.

2.1.4 The unit duct price shall include all the duct hangers and supports, exposing of concrete reinforcement for supports and making good of the same as well as any materials and labour required to complete the duct frame.

3. **Measurements of Piping, Fittings, Valves, Fabricated Items:**

3.1 **Pipe**

(Including water piping, steam piping, oil piping, lP gas piping, air piping, vacuum piping) etc.

3.1.1 All pipes shall be measured in linear meter (to the Nearest cm) along the axis of the pipes and rates shall be inclusive of all fittings e.g. Tees, bends, reducers, elbows etc. Deduction shall be made for valves in the line.

3.1.2 Exposing reinforcement in wall and ceiling and floor of possible and making good the same or installing anchor fasteners and inclusive of all items as specified in specifications and schedule of quantities.

3.1.3 Rates quoted shall be inclusive of providing and fixing Vibration pads and wooden pieces, wherever specified or required by the project coordinator.

3.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter, with no additional allowance being made for providing the same.

3.1.5 The length of the pipe for the purpose of payment will be taken through the centerline of the pipe and all fittings (e.g. Tees, bends, reducers, elbows, etc.) as through the fittings are also presumed to be pipe lengths. Nothing extra whatsoever will be paid for over and above for the fittings for valves and flanges, section 3.2 below applies.

3.2 **Valves and Flanges**

3.2.1 All the extra CI & cm flanged valves shall be measured according to the nominal size in mm and shall be measured by number. Such valves shall not be counted as part of pipe length hence deduction in pipe length will be made wherever valves occur.

3.2.2 All gun metal (gate & globe) valves shall include two Nos. of flanges and two numbers 150 mm long ms nipples, with one side threaded matching one of the valves, and other welded to the M.S. Slip-on-flange. Rate shall also include the necessary number of bolts,

nuts and washers, 3 mm thick insertion gasket of required temp. grade and all items specified in the specifications.

3.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks, pumps etc. And the connection made with an installed pipe line shall be included in the rates as per the B.O.Q.

3.3 **Structural Supports**

Structural supports including supports fabricated from pipe lengths for pipes shall be measured as part of pipe line and hence no separate payment will be made. Rates shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as described in specifications, drawings and schedule of quantities or as required at site by project coordinator.

3.4 **Copper Connections for Fan Coil Units**

3.4.1 Copper connection assembly for making connections to the fan coil units shall be measured, as part of the fan coil unit price and shall include brass flare nuts, brass straight connector, brass tees, brass reducing fittings, fixing of automatic 2way valve, making connections and leak testing, complete assembly as per specifications and drawings. Nothing extra shall be payable on account of any variation in the length of copper pipe.

4. **Insulation:**

4.1 The measurement for vessels, piping, and ducts shall be made over the bare uninsulated surface area of the metal.

4.2 **Pipes, Ducts & Vessels**

4.2.1 **Pipes**

The measurements for installation of piping shall be made in linear meters through all valves, flanges, and fittings. Pipes/bends shall be measured along the centerline radius between tangent points. If the outer radius is R1 and the inner radius is R2. The centre line radius shall be measured as (R1+R2)/2. Measurement

of all valves, flanges and fittings shall be measured with the running meter of pipe line as if they are also pipe lengths. Nothing extra over the above shall be payable for insulation over valves, flanges and fittings in pipe line/routings. Fittings that connect two or more different sizes of pipe shall be measured as part of the larger size.

4.2.2 **Ducts**

The measurements for insulation of ducts shall be made in actual square meters of bare uninsulated duct surface through all dampers, flanges and fittings. In case of bends the area shall be worked out by taking an average of inner and outer lengths of the bends. Measurements for the dampers, flanges, fittings shall be for the surface dimension for the connecting duct, nothing extra over the above shall be payable for insulation over dampers, flanges and fittings in duct routing.

Annexure – I

LIST OF APPROVED BRANDS/ MATERIALS

1. The Contractor shall obtain prior approval from the Engineer-in-charge before placing order for any specific material.
2. Wherever applicable, the Engineer-in-charge may approve any material equivalent to that specified in the tender subject to proof being offered by the Contractor for equivalence to his satisfaction. In case on non-availability of the brand specified in the contract, the Contractor shall submit the documentary evidence of non-availability of approved brand and suggest the alternate brand of equivalent quality for the approval of the competent authority. It will be at the discretion of the Engineer-in-Charge to approve or reject the brand suggested by the contractor and approve the name of any other equivalent brand.
3. Unless otherwise specified, the brand/make of the material as specified in the item nomenclature, in the particular specifications and in the list of approved materials attached in the tender, shall be used in the work.

Sl. No.	Description of Items	Approved Makes & Models
1	Split Units/VRV/VRF	Toshiba / Daikin / /Hitachi
2	Cassette/Hi-wall/Ductable	Toshiba / Daikin / /Hitachi
3	G.I. sheet	Tata /Sail /Bhushan /National /Jindal
4	Factory Ducting	Ductofab /Zeco /Dustech
5	Electrical Panel	Application / RR Control / SPC
6	Grills/Diffuser/Louver	Mapro /Conair /Caryaire /Cross air
7	VCD	Air flow /Conair /Balance Air Equipment
8	Fire Damper/Actuator	Mapro /Conair /Caryaire /Cross air
9	Inline Fan	Ostberg /Airflow /Caryaire /Sphere
10	Propeller fan	Caryaire /Daspass /Crompton
11	Drain pump	Aspen
Controls		
1	Electric motors	Siemens /Crompton /Bharat Bijlee /ABB
Pipes		
1	Refrigerant piping	Mandev /Maxflow /Mehta Tubes /Indigo
2	UPVC	Prince /Supreme
Insulation		
1	Acoustic/Nitrile rubber	UP Twiga /Saint Gobain /Owen Corning
2	Glass wool	UP Twiga /Saint Gobain /Owen Corning
3	Cable tray	Fedders Lloyd /MEM /Rico
4	Control & transmission wiring/ Controller wiring	Havells /Polycab /Rallison
6	Power Cabling	Havells /Polycab /Skytone

Annexure – II

ITEMS PROPOSED TO BE PROVIDED BY THE BIDDER

Sl. No	Description of Items Party	Tenderer should specify makes & models quoted in this tender against concerned items as per our specified make.
1	Split Units/VRV/VRF	
2	Cassette/Hi-wall/Ductable	
3	G.I. sheet	
4	Factory Ducting	
5	Electrical Panel	
6	Grills/Diffuser/Louver	
7	VCD	
8	Fire Damper/Actuator	
9	Inline Fan	
10	Propeller fan	
11	Drain pump	
Controls		
1	Electric motors	
Pipes		
1	Refrigerant piping	
2	UPVC	
Insulation		
1	Acoustic/Nitrile rubber	
2	Glass wool	
3	Cable tray	
4	Control & transmission wiring/ Controller wiring	
6	Power Cabling	

Signature of the tenderer with seal

Annexure – III

Integrity Pact

To,

The Dean - Infrastructure & Planning,
Indian Institute of Information Technology Sri City, Chittoor
630, Gnan Marg, Sri City
Chittoor District – 517 646
Andhra Pradesh.

Sub: Submission of Tender for the Work Supply, Installation, Testing and Commissioning of VRV / VRF Type Air Conditioning System for labs and other areas in Academic Block of Indian Institute of Information Technology Sri City, Chittoor as per the requirements & specification.

Dear Sir,

I/We acknowledge that IIIT Sri City is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender/bid document.

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of tender documents, failing which I/We will stand disqualified from the tendering process.

I/We acknowledge that the making of the bid shall be regarded as an unconditional and absolute acceptance of this condition of the NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when tender/bid is finally accepted by IIIT Sri City. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with Article 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept the Integrity Agreement, while submitting the tender/bid, IIIT Sri City shall have unqualified, absolute and unfettered right to disqualify the tenderer/bidder and reject the tender/bid is accordance with terms and conditions of the tender/bid.

Yours faithfully

(Duly authorized signatory of the Bidder(s)

Signature of the tenderer with seal

INTEGRITY AGREEMENT

This Integrity Agreement is made at ..... on this ..... Day of. 2025

BETWEEN

The Dean - Infrastructure & Planning, Indian Institute of Information Technology Sri City, Chittoor, 630, Gnan Marg, Sri City, Chittoor District – 517 646, Andhra Pradesh.

IIIT Sri City, (Hereinafter referred as the 'Institute', which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

AND

.....
(Name and Address of the Individual/Firm/Company) through ..... (Hereinafter referred to as the
(Details of duly authorized signatory)
"Bidder/Contractor" and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

Preamble

WHEREAS the Institute has floated the Tender [NIT No. IIITS/NIT/HVAC/2025/037] (hereinafter referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, contract for "Supply, installation, testing and commissioning of VRV / VRF Type Air Conditioning System at IIIT Sri City Campus" hereinafter referred to as the "Contract".

AND WHEREAS the Institute values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its Bidder(s) and Contractor(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as "Integrity Pact" or "Pact"), the terms and conditions of which shall also be read as integral part and parcel of the Tender/Bid documents and Contract between the parties.

NOW, THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:

Article 1: Commitment of the Institute

1) The Institute commits itself to take all measures necessary to prevent corruption and to observe the following principles:
   (a) No employee of the Institute, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
   (b) The Institute will, during the Tender process, treat all Bidder(s) with equity and reason. The Principal/Owner will, in particular, before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the Tender process or the Contract execution.
   (c) The Institute shall endeavor to exclude from the Tender process any person, whose conduct in the past has been of biased nature.
2) If the Institute obtains information on the conduct of any of its employees which isa criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there bea substantive suspicion in this regard, the Institute will inform the Chief Vigilance Officer and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder (s) / Contractor (s)

1) It is required that each Bidder/Contractor (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the IIIT Sri City all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.
2) The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution:

   a) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal/Owner's employees involved in the tender process or execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the contract.

   b) The Bidder(s)/Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non- submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.

c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s)/Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the names and addresses of agents/representatives in India, if any. Similarly, Bidder(s)/Contractor(s) of Indian Nationality shall disclose names and addresses of foreign agents/representatives, if any. Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both. Further, in cases where an agent participates in a tender on behalf of one manufacturer, he shall not be allowed to quote on behalf of another manufacturer along with the first manufacturer in a subsequent/parallel tender for the same item.

e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

3) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

4) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm indulge in fraudulent practice means a willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the Government interests.

5) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm use Coercive Practices (means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/ her reputation or property to influence their participation in the tendering process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Institute under law or the Contract or its established policies and laid down procedures, the Institute shall have the following rights in case of breach of this Integrity Pact by the Bidder(s)/Contractor(s) and the bidder/contractor accepts and undertakes to respect and uphold the Institute's absolute right:

1) If the Bidder(s)/Contractor(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Institute after

giving 14 days' notice to the contractor shall have powers to disqualify the Bidder(s)/Contractor(s) from the tender process or terminate/determine the Contract, if already executed or exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Institute. Such exclusion may be forever or for a limited period as decided by the Institute.

2) Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Institute has disqualified the Bidder(s) from the tender process prior to the award of the contract or terminated/determined the contract or has accrued the right to terminate/determine the contract according to Article 3(1), the Institute apart from exercising any legal rights that may have accrued to the Institute, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and Security Deposit of the Bidder/Contractor.

3) Criminal Liability: If the Institute obtains knowledge of conduct of a bidder or Contractor, or of an employee or a representative or an associate of a bidder or Contractor which constitutes corruption within the meaning of IPC Act, or if the Institute has substantive suspicion in this regard, the Institute will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

1) The Bidder declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the Tender process.

2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken for banning of business dealings/ holiday listing of the Bidder/Contractor as deemed fit by the Institute.

3) If the Bidder/Contractor can prove that he has resorted / recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal/Owner may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Bidders/Contractors/Subcontractors

1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact. The Bidder/Contractor shall be responsible for any violation(s) of the principles laid down in this agreement/Pact by any of its Subcontractors/ sub-vendors.

2) The Institute will enter into Pacts on identical terms as this one with all Bidders and Contractors.

3) The Institute will disqualify Bidders, who do not submit, the duly signed Pact between the Institute and the bidder, along with the Tender or violate its provisions at any stage of the Tender process, from the Tender process.

Article 6: Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Contractor/Vendor 12 months after the completion of work under the contract or till the continuation of defect liability period, whichever is more and for all other bidders, till the Contract has been awarded.

If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, IIIT Sri City.

Article 7: Other Provisions

1) This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Division of the Institute, who has floated the Tender.
2) Changes and supplements need to be made in writing. Side agreements have not been made.
3) If the Contractor is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Pact must be signed by a representative duly authorized by board resolution.
4) Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.
5) It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement / Pact, any action taken by the Institute in accordance with this Integrity Agreement/ Pact or interpretation thereof shall not be subject to arbitration.

Article 8: Legal & Prior Rights

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Tender/Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

.....
(For and on behalf of Institute)

.....

Signature of the tenderer with seal

(For and on behalf of Bidder/Contractor)

WITNESSES:

1. .....
(Signature, name and address)

2. .....
(Signature, name and address)

Place:
Date:

Annexure – IV

PROFORMA OF EXPERIENCE
DETAILS OF SIMILAR WORKS CARRIED OUT BY THE FIRM

(SEPARATE SHEETS TO BE ATTACHED)

S. No	NAME OF ORGANISTON	NAME OF WORK	CONTRACT VALUE	SCHEDULED DATE and ACTUAL DATEOF COMPLETION (EXTN. OF TIME, IF ANY)	ACTUAL REASON FOR DELAY IN COMPLETION, IF ANY

Signature of the tenderer with seal

Annexure – V

DETAILS TO BE FURNISHED BY THE BIDDERS

1. Name of the Firm/Company:
   (Attach copy of the Registration Certificate)

2. Address for Communication:

3. Contact Person Telephone/ Mobile No.:

4. E-mail:

5. Details of Proprietor/partner/Director

6. GST Registration No.:
   (Attach copy of the GST Registration Certificate)

7. PAN Number:
   (Attach copy of the PAN Card)

This is to certify that the above facts are true complete and correct to the best of my knowledge and belief. Further, it is certified that I/We have read and understood the terms and conditions of the Tender Notice.

I/We give an undertaking and give our unconditional and unequivocal acceptance of all terms and conditions of the Tender and agree to abide by these terms and conditions.

Name and Signature of the Firm/Company
Seal of the Firm/Company

Annexure – VI

Declaration regarding black-listing and/ or litigations

I/we hereby declare that our firm/agency is not black-listed by any Ministry or Department of Central Government/State Government or PSU or other bodies under the Central Government/State Government. I/we further declare that no criminal case is registered or pending against the firm/company or its owner/partners/directors anywhere in India.

Date the ..... day of 2025

Signature of Bidder ……..

Name & Address of Bidder ……..

……

……

Annexure – VII

FINANCIAL INFORMATION

1. **Banker Details**
   Name of the Bank :
   Branch with Address :
   Contact Person in the Bank :
   Contact Details :
2. **Details of Chartered Accountant**
   Name & Address :
   Registration Details of CA :
   Contact Details :
   Email Address :
3. **Financial Analysis**
   Details to be furnished duly supported by figures in Balance Sheet / Profit and Loss Account for the last Five (5) years duly certified by the Chartered Accountant, as submitted by the applicant to the Income-Tax Department (Copies to be attached).

Particulars	2020-21	2021-22	2022-23	2023-24	2024-25
1. Gross Annual Turn-over in Construction Works					
2. Profit / Loss					
3. Financial Position:					
a. Cash					
b. Current Assets					
c. Current Liabilities					
d. Working Capital (b – c)					

4. **Income Tax Clearance Certificate duly attested by the CA.**
5. **Financial arrangements for carrying out the proposed works**

....
(Signature of the Chartered Accountant) (Signature of the Applicant)

Annexure – VIII

Format of Bank Guarantee for Performance Security

To
The Dean - Infrastructure & Planning,
Indian Institute of Information Technology Sri City, Chittoor
No. 630, Gnan Marg, Sri City,
Chittoor District – 517 646
Andhra Pradesh.

WHEREAS… ..... (name and address of contractor) thereinafter called "the contractor" has
undertaken, in pursuance of Contract No. …… Dated …… to execute……..
(Name of Contract and brief description of Works) (hereinafter called "the contract").

AND WHEREAS it has been stipulated by you in the said contract that the Contractor shall furnish you with a Bank Guarantee by a Nationalized/Scheduled bank of India for the sum specified therein as performance guarantee for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREOF we hereby affirm that we are the guarantor and responsible to you on behalf of the Contractor, up to a total of Rs…… (amount of guarantee) (Rupees.. (in words), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of …….. (amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the contract or of the works to be performed there under or of any of the contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

Signature of the tenderer with seal

This guarantee shall be valid until 60 days beyond the date of stipulated completion.

Signature and seal of the Guarantor……
Name of the Bank ……
Address……

Date……
In the presence of ……
1……
(Name of Occupation)
2 ……
(Name of Occupation)

An amount shall be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract and denominated in Indian Rupees.

Annexure – IX

Performa for Agreement

(TO BE SUBMITTED ON RS.100/- NON JUDICIAL STAMP PAPER)

CONTRACT AGREEMENT FOR THE WORK OF ……..…....
Made this …… Day of……..
Between…….. M/s ……..

Hereinafter called the "Contractor" (which terms shall unless excluded by or repugnant to the context include its successors and permitted assigns) of the one part; and Indian Institute of Information Technology Sri City, Chittoor, 630, Gnan Marg, Sri City, Chittoor District – 517 646 (A.P.) hereinafter called the "OWNER" (which terms shall unless excluded by or repugnant to the context include its successors and permitted assigns) of the other part.

WHEREAS

a) OWNER being desirous of getting executed the WORK mentioned, enumerated or referred to in the Bid Document including Notice Inviting Tender, Instruction to Bidders, General Condition of Contract, Special Conditions of Contract, Specifications, Time Schedule, Letter of Acceptance of Bid and other documents has invited Bids.
b) CONTRACTOR has inspected SITE and surroundings of WORK specified in the Bid Documents and satisfied himself by careful examination before submitting his Bid as to the nature of the quantities, nature and magnitude of WORK, availability of equipment etc. necessary for the execution of WORK, the means of access to SITE, the position of supply of power and water thereto and the accommodation he may require and has made local and independent enquiries and obtained complete information as to the matters and things referred to, or implied in the Bid Document or having any connection there with, and has considered the nature and extent of all probable and possible situation, delays, hindrances or interferences to or with the execution and completion of WORK, to be carried out under this CONTRACT, and has examined and considered all other matters condition and things and probably and possibly contingencies, and generally all matters incidental thereto and ancillary thereof effecting the execution and completion of WORK and which might have influenced him in making his Bid.
c) The Invitation to Bid, instructions to Bidders, General Conditions of Contract, Description of Works and specifications, Plans, Time Schedule, Letter of Acceptance of Bid any and any other documents and enclosures, copies of which are hereto annexed are included in the expression "CONTRACT" :

AND WHEREAS

OWNER accepted the Bid of CONTRACTOR for the provision and the execution of WORK at the CONTRACT PRICE as indicated in the letter of award of work upon the terms and subject to the conditions of Contract.

Signature of the tenderer with seal

Now this CONTRACT AGREEMENT witnessed and it is hereby agreed and declared as follows:

1. In consideration of the payment to be made to CONTRACTOR for WORK to be executed by him, CONTRACTOR hereby covenants with OWNER that CONTRACTOR shall and will duly provide, execute and complete the work and things in CONTRACT, mentioned or described or which are to be implied therefrom or may be reasonably necessary for completion or stipulations mentioned in CONTRACT.

2. In consideration of the due provision, execution and completion of WORK by the CONTRACTOR in accordance with the terms of the CONTRACT, the Owner does hereby agree with CONTRACTOR that OWNER will pay to Contactor the respective amount for the work actually done by him and approved by Owner as per Payment Terms accepted in CONTRACT and payable to CONTRACTOR under provision of Contract; such payment to be made at such time and such manner as provided for in the CONTRACT.

AND

3. In consideration of the due provision, execution and completion of WORK, CONTRACTOR does hereby agree to pay such sums as may be due to OWNER for the services rendered by Owner to Contractor as set forth in CONTRACT and such other sums as may become payable to Owner towards loss, damage to the OWNER's equipment, materials etc. and such payments to be made at such time and in such manner as in provided in the CONTRACT.

IN WITNESS WHEREOF Parties executed these presents on the day and the year above written.

Signed and Delivered for and on behalf of CONTRACTOR …….. ……..	Signed and Delivered for and on behalf of OWNER (IIIT Sri City) …….. ……..
Date: …… Place: ……..	Date: …….. Place: ……

In presence of Witness (Signature with Name & Address)

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

Signature of the tenderer with seal

Supply, Installation, Testing and Commissioning of VRV / VRF Type Air Conditioning System for labs and other areas in Academic Block of Indian Institute of Information Technology Sri City, Chittoor as per the requirements & specification

PART – II

PRICE BID

[Bidders to refer/use the online CPP Portal BOQ for Pricing]