



**Tender Documents for HVAC System and
Ancillary Work for Academic Block-V at
Sukkur IBA University**

Tender PROC/EPADS/31/2024-25

Sukkur IBA University


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 Sukkur IBA University www.iba-suk.edu.pk			
NOTICE INVITING RE-TENDER (THROUGH EPADS) Tender Proc/EPADS/31/2024-25			
<p>Sukkur IBA University invites electronically sealed bids through EPADS (E-Pak Acquisition & Disposal System) on a single stage two envelope procedure from well-established, reputed, and experienced firms registered with the income tax and sales tax (SRB) departments for the following works. Manual bids will not be considered.</p>			
S. No.	Name of Works	Estimated Cost Rs. in Million	Time for completion
01	HVAC System and Ancillary Work for Academic Block-V at Sukkur IBA University	218.755	04 Months
Tender Schedule - Date and Time			
	From	To	Submission
	February 25, 2025	March 13, 2025	13-03-2025 03:00 PM Through EPADS
			Opening
			13-03-2025 03:30 PM Through EPADS
<p>Eligibility: Valid Registration with FBR, SRB & PEC (PEC'S Category C-3 Registered in Mechanical Engineering ME-01).</p>			
<p>Qualification:</p>			
<p>(i) List of similar assignments undertaken over the past 05 years.</p>			
<p>(ii) Financial Statement (summary) and income tax return for the last 03 years.</p>			
<p>(iii) List of litigation (if any) their nature and status/outcomes.</p>			
<p>(iv) Evidence shows that the annual turnover of the company is equal to or more than the estimated cost.</p>			
<p>(v) Company profile (including Date of establishment, details of the work done, work in hand, details of technical staff/ manpower engaged etc.)</p>			
<p>(vi) Affidavit that the firm is not blacklisted.</p>			
<p>Terms & Conditions</p>			
<p>(a) Under the following conditions, the bid will be rejected: -</p>			
<p>(i) Conditional bids/tenders.</p>			
<p>(ii) Bids not accompanied by a bid security of the required amount and form.</p>			
<p>(iii) Blacklisted firms.</p>			
<p>Bidding documents can be obtained and submitted through EPADS as per the above schedule. Bidders are requested to give their Best and Final Price "No Negotiations" is permitted. Bidding Documents containing detailed terms and conditions can be downloaded from the following websites & submitted electronically through EPADS.</p>			
<p>https://portalsindh.eprocure.gov.pk</p>			
<p>and https://www.iba-suk.edu.pk/tenders</p>			
<p>Bid Security @ 2% of Bid Cost in the shape of a pay order should be in favor of "Sukkur IBA University."</p>			
<p>The procuring agency reserves the right to accept or reject any or all bids prior to the acceptance of a bid as per SPP Rules 2010 (Amended to date).</p>			
<p>In case of any query/confusion, please email at: pd@iba-suk.edu.pk and tahseen.memon@iba-suk.edu.pk</p>			
<p>PROJECT DIRECTOR</p>			
<p>SUKKUR IBA UNIVERSITY</p>			
<p>Nisar Ahmed Siddiqui Road, Sukkur. Ph: 071-5644025-26</p>			
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SECTION-01

INSTRUCTIONS TO TENDERERS AND TERMS & CONDITIONS

1. The Sukkur IBA University invites sealed tenders from well-established, reputed, and experienced firms registered with the income tax and sales tax (SRB) department, and Pakistan Engineering Council for the Supply and Installation of HVAC System and Ancillary Work for Academic Block-V.
2. A complete set of Bidding Documents may be downloaded from <https://portalsindh.eprocure.gov.pk/> and [Tenders - Sukkur IBA University](#) . For any query Bidders may contact the Office of the Project Director, Sukkur IBA University, at (pd@iba-suk.edu.pk).
3. All bids must be accompanied by a Bid Security of 2% percent of the bid price in the form of (*pay order / demand draft*) and must be uploaded on EPADS and delivered to the PD Office Administration Block (Earnest Money Pay Order Only) at or before 15:00 hours, on March 13, 2025. Bids will open at 15:30 hour on the same day via EPADS.
4. A Pre-Bid Meeting will be held on March 06, 2025, at 11:00 in the Board Room, Administration Block, Sukkur IBA University, Sukkur, to address queries and facilitate a site visit for contractors' understanding.
5. The tenderers are required to furnish the following information in addition to that required in the tender notice & Evaluation Criteria with their tenders, failing which their tenders are liable to be rejected:
 - i) Organization structure of the “Contracting Firm” (whether the firm is a partnership or Limited Company etc.
 - ii) Details of works of similar nature executed during the last five years with Supported by documentary evidence (Photostat copies to be attached).
 - iii) Proof of financial stability.
 - iv) Programme of work to ensure that the work will be completed within the Allotted time on the prescribed format.
 - v) Undertaking the effect that the firm is not blacklisted by any Government / Semi Government / Private Organization.
 - vi) The Contractor /Bidders must be the sole distributor/authorized distributor for five Years (5Years) of the offered brand/system.
 - vii) The Contractors / Bidders must be licensed by the Pakistan Engineering Council. (PEC’s Category C-3 & ME-01).
6. Set of tender documents, duly signed on each page and official seal stamped on each page including annexure, Addendum/Corrigendum, if any and supplementary information and **Earnest Money @ 2%** of the quoted rates in shape of Pay Order / Demand Draft in favor of Sukkur IBA University, valid for a minimum period of twenty eight (28) days beyond the bid validity date (i.e.90 days+28 days validity) from any Schedule Bank registered in Pakistan on prescribed format (refundable to unsuccessful



bidder after award of Contract) must be uploaded on EPADS also Earnest Money must be submitted to the office of the Project Director on or before the time and date fixed in the Tender notice for receipt of the Tenders.

7. Tender must be filled in English and all enclosed documents should be in English.
8. Bids should be valid for ninety (90) calendar days from the Tender opening date.
9. Documents submitted by Tenderers in connection with the Tender for above named Works will be treated as confidential and will not be returned, except Financial Proposal of Non-responsive Bidders.
10. Incomplete and Conditional Tenders shall be rejected at the sole discretion of the Employer.
11. Tenderers will not be reimbursed for any expenses of any kind whatsoever incurred in connection with preparation and submission of their Tenders.
12. Unit rates should be mentioned both in word and figures in Pak Rupees. If there is a discrepancy between the Unit Price & Total Price i.e. obtained by multiplying the Unit Price and quantity, the Unit price shall prevail and the total price shall be corrected. If there is a discrepancy between the words and figures, the amount in the words shall prevail. If there is a discrepancy between the total bid price entering the Form of Bid and the total shown in the Schedule of Prices, the amount stated in the Form of Bid will be corrected by the Employer's Engineer in accordance with the corrected Schedule of Price. If the Bidder does not accept the corrected amount of Bid, his Bid will be rejected, and his Bid Security will be forfeited.
13. The entire work should be completed within **17 weeks** from the date of issue of the work order.
14. The rates should be inclusive of all taxes (including GST, customs & other duties, Govt. Levy as applicable at the time of Payment), insurance, overheads, transportation, labor charges for handling, commissioning and testing at the site etc.
15. The supplier/contractor should be registered with the General Sales Tax, Income tax Departments and Sindh Sales Tax and should submit GST and SST invoices with the bill.
16. Exemption of Income Tax will only be allowed against the Exemption Certificate issued by the Income Tax Department.
17. The supplier /contractor will submit GST Registration Certificate, GST Invoice and paid copy of Professional Tax along with the bill. The bill will not be entertained without these documents.
18. The supplier/Contractor may visit the site on any working day to form a clear understanding of the work, before quoting the rates.
19. The contractor/supplier should provide complete information including Technical computerized selection, catalogues, selection drawing, technical Submittal along with the dimensional drawings, sectional details, technical details, certificates mentioned in the specification/tender documents etc. for the quoted equipment with the Bid.



20. In case of award of work, 10% (ten percent) of the billed amount will be deducted from every bill as security deposit.
21. The **Earnest Money at 2%** of the quoted rates in shape of Pay Order / Demand Draft in favor of Sukkur IBA University, valid for a minimum period of twenty-eight (28) days beyond the bid validity date (i.e. **90** days + 28 days validity). The Bank Guarantee should be from any Scheduled Bank registered in Pakistan on prescribed format.
22. Conditional/incomplete tenders and tenders without earnest money will not be accepted.
23. This tender is only an invitation to offer, and the Sukkur IBA University reserves the right to accept or reject any or all tenders.
24. If the tender/bid does not meet the specifications and other requirements, the same will be rejected and their Financial Bid will be returned un-opened.
25. In case of acceptance of tender, the supplier/contractor will submit a Performance Bond amounting to 10% of tender cost in shape of Bank Guarantee **within 28 days** of issuance of Acceptance Letter. Performance Bond shall be issued by any Scheduled Bank registered in Pakistan on prescribed format. Performance Bond shall be valid for the following period:
- (a) **24 Weeks** (for execution of works as prescribed in Schedule of Prices, Specifications etc.)
- (b) For Maintenance / Warranty Period which shall be started after completing the entire scope of works as per Contract. The same shall be valid for the whole Currency of Works including Maintenance / Warranty Period
26. If Contractor fails to provide Performance Bond, the Earnest Money will be forfeited, and the client reserves the right to re-tender the work, and he will not be allowed to participate in future tenders with Sukkur IBA University.
27. The successful tenderers shall have to execute Agreement with the **Sukkur IBA University**, within 14 days after issuance of acceptance letter, in its standard form by E-Stamp Duty as per rules of Sindh Government. In case of default the Earnest Money will be forfeited, and the client reserves the right to cancel the tender. After execution of the Agreement, the work order for commencement of the work shall be issued.
28. The contractor will submit 03 sets of operation & maintenance manuals, spares manual As Built Drawings along with / before the Delivery of the Equipment.
29. The employer proposes to advance an amount equal to 10% of tendered cost as mobilization advance against a bank guarantee, to be obtained by the supplier/contractor at his own expenses from any Scheduled Bank registered in Pakistan as per Proforma of the agreement-cum-guarantee included in this tender document.
30. The total amount of mobilization advance will be recovered from the contractor's Running / interim bills.
31. The client reserved the right to increase /decrease the quantity mentioned in BOQ up



to any extent as per their requirements / budget.

32. TERMS OF PAYMENTS

31.1 For Terms and payments refer, refer Section-03

33. PENALTIES

32.1 For Penalties, refer Section 03

33. WARRANTY

33.1 The Equipment shall be covered under the Standard Warranty Period of 30 Months from the date of Shipment / 24 Months from the date of commissioning whichever occurs earlier. However, extended Warranty Period may be offered by any Supplier

TERMS AND CONDITIONS

Clause - 1: Commencement & Completion Dates of work. The contractor shall not enter upon or commence any portion of work except with the written authority and instructions of the Head of Procurement. However, BoQ and execution of work shall be performed with due approval & supervision of HVAC Engineer or subordinate-in-charge of the work. Failing such authorities the contractor shall have no claim to ask for measurements or payment for work.

The contractor shall proceed with the work with due expedition and without delay completing the work in the time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor and shall be reckoned from the date on which the order to commence work is given to the contractor. And further, to ensure good progress during the execution of the work, the contractor shall be bound, in all in which the time allowed for completion of any work exceeds one month, to achieve progress on a prorated basis.

Clause - 2: Liquidated Damages. 2% liquidated damages of the total amount will be imposed per month for which the company/firm/agency failed to complete work within the delivery/execution period and maximum up to 10%.

Clause-3: Termination of the Contract.

“Sukkur IBA University” may terminate this contract if the job is not executed according to the requirement at any time after issuing a 15 days’ notice. Sukkur IBA University reserves the right to accept or reject any or all contract(s) or terminate proceedings at any stage in accordance with the rules & regulations in the relevant SBD notified by SPPRA.

Clause 4: Possession of the site and claims for compensation for delay. The Engineer shall give possession of all parts of the site to the contractor. If possession of site is not given by the date stated in the contract data, no compensation shall be allowed for any delay caused in the start of the work on account of any acquisition of land, water standing in borrow pits/



compartments or according to sanction to estimates. In such a case, either the date of commencement will be changed, or the period of completion is to be extended accordingly.

Clause –5: Extension of Intended Completion Date. A variation Sukkur IBA University, Sukkur either at its own initiatives before the date of completion or on desire of the contractor may extend the intended completion date, if an event (which hinders the execution of contract) occurs or a variation order is issued which makes it impossible to complete the work by the intended completion date for such period as he may think necessary or proper. The decision of the Executive Engineer in this matter shall be final; where time has been extended under this or any other clause of this agreement, the date for completion of the work shall be the date fixed by the order giving the extension or by the aggregate of all such orders made under this agreement. When the time has been extended as aforesaid, it shall continue to be the essence of the contract, and all clauses of the contract shall continue to be operative during the extended period.

Clause –6: Specifications. The contractor shall execute the whole and every part of the work in the most substantial and work-man-like manner and both as regards materials and all other matters in strict accordance with the specifications lodged in the office of the Project Director or HVAC Engineer and initiated by the parties, the said specification being a part of the contract.

Clause–7: Payments. Payment will be made after completion of work/job/project and submission of bill/invoice. Clearance from HVAC Engineer and Project Director is required before the process of bill/invoice.

Clause–8: Reduced Rates. In cases where the items of work are not accepted as so completed, the Project Director may make payment on account of such items at such reduced rates as may consider reasonable in the preparation of final or on running account bills with reasons recorded in writing.

Clause–9: Issuance of Variation and Repeat Orders. Any cumulative variation, beyond 15% of the initial contract amount, shall be subject to another contract to be tendered out if the works are separable from the original contract.

Clause-10: Quality Control.

- (a) Identifying Defects:** If at any time before the security deposit is refunded to the contractor/during defect liability period mentioned in bid data the IBA authorities may instruct the contractor to uncover and test any part of the works which he consider may have a defect due to use of unsound materials or unskillful workmanship and the contractor has to carry out a test at his own cost irrespective of work already approved or paid.
- (b) Correction of Defects:** The contractor shall be bound forthwith to rectify or remove and reconstruct the work so specified in whole or in part, as the case may require. The contractor shall correct the notified defect within the Defects Correction Period mentioned in notice.



Clause–11: Inspection of Operations. HVAC Engineer and his subordinates shall at all reasonable times have access to the site for supervision and inspection of works under or in course of execution in pursuance of the contract and the contractor shall afford every facility for and every assistance in obtaining the right to such access.

Clause–12: Risks. The contractor shall be responsible for all risks of loss of or damage to physical property or facilities or related services at the premises which arise during and in consequence of the performance of the contract. If any damage is caused while the work is in progress or becomes apparent within three months of the grant of the certificate of completion, final or otherwise, the contractor shall make good the same at his own expense.

Clause-13: Measures for prevention of fire and safety measures. The contractor shall not set fire to any standing jungle, trees, bush wood, or grass. The contractor is responsible for the safety of all its activities including protection of the environment on and off the site. Compensation for all damage done intentionally or unintentionally on or off the site by the contractor's labor shall be paid by him. All staff must have CNIC and clearly mentioned to discourage work through child labor. SIBAU is a no smoking zone. Life Insurance / Security of workers will be the responsibility of contractor. SIBAU will not be responsible for any mishap.

Clause-14: Sub-contracting. The contractor shall not subcontract the whole of the works, except where otherwise provided by the contract. The contractor shall not subcontract any part of the work without the prior consent of the Project Director. Any such consent shall not relieve the contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any subcontractor, his agents, servants, or workmen as if these acts, defaults, or neglects were those of the contractor, his agents' servants, or workmen. The provisions of this contract shall apply to the subcontractor or his employees as if he or it were employees of the contractor.

Clause–15: Disputes. In case of any dispute, difference or and question which may at any time arise between the parties hereto or any person under them, arising out in respect of this letter of intent or this subject matter thereof shall be referred to the Registrar of the Sukkur IBA University and CEO of the "THE CONTRACTOR" for arbitration/settling of the dispute, failing which the decision of the court law in the jurisdiction of Sukkur binding to the parties. The Arbitration proceedings will be governed by the Arbitration Act, 1940 and the Substantive and procedural law of Pakistan. The venue shall be Sukkur.

Clause–16: Site Clearance. On completion of the work, it will be responsibility of the Contractor to remove debris/sludge/garbage/waste material/left over material, machineries, equipment, and manpower from the site at their own cost after completion of works/jobs/project. However, clearance will be required from the Project Director.

Clause –17: Financial Assistance /Advance Payment.

(a) **Mobilization advance:** 10% mobilization advance is allowed conditionally with the submission of Bank Guarantee.

Clause–18: Performance Security. A successful bidder should provide 10% Performance Security of the total value of the Work Order in the form of a Pay Order or bank guarantee after acceptance of the Work Order.



Clause-19: Receiving/Acceptance of Work Order: The contractor will sign the copy of the Work Order as acknowledgement.

Clause-20: Place of Execution: As specified in the Work Order.

Clause-21: Quantity Delivered: Competent Authority reserves the right to remove any item or work as per rules.

Clause-22: Condition of Works: All works must meet in all respects with the BoQ of the Order and must be in good condition otherwise they will be liable to reject.

Clause-23: Delivery of Works: All the works must be executed to the specified site of the Sukkur IBA University.

Clause-24: Rejection of Works: Sukkur IBA University, Sukkur reserves the right to cancel any or all the items if works is not in accordance with our specification or if delayed occurred.

Clause-25: Price / Rate/Charges/Cost: Rate / charges / cost must be quoted on Tender Form only and submitted in sealed envelope. The quoted rate/charges/cost will be final, and no change will be accepted after opening of tenders, unless or otherwise if change in specs occurred.

Clause-26: Bid Security: 2% Bid Security should be on Total Amount submitted/attached along with the tender form in shape of PAY ORDER / DEMAND DRAFT only in the name of Sukkur IBA University.

Clause-27: Rules, Regulations & Policies: All rules, regulations and policies will be governed in accordance with the SPPRA & SIBAU PP&P.

Clause-28: Rights: SIBAU, Sukkur may reject any bid subject to relevant provision of SPP Rules 2010 any may cancel the bidding process at any time prior to acceptance of bid or proposal as per Rule-25(i) of said rules. SIBAU, also reserve the right to issue Work Order for any part of project to different lowest responsive bidders or issue Work Order for all the project to any lowest responsive bidder.

Clause-29: SIBAU, Priorities: SIBAU reserves the right to award contract in phases accommodation wise as per SIBAU priorities.

Clause-30: Government tax(es), levy(es) and charges(s): All Government taxes (including Income tax and stamp duty), levies and charges will be charged as per SRO and as per applicable rates / denomination of Purchase / Work Order.

Clause-31: E-Stamp Duty: Stamp duty as per Sindh Government' rules for Services against total value of Work Order will be levied accordingly.



Clause-32: Measurement Book: Entry & Endorsement in Measurement Book for all jobs completed is mandatory. The Measurement Book is to be countersigned by Project Director on each occurrence / daily basis.

Clause-33: Blacklisted: Contractor is required to provide affidavit that the firm is not Blacklisted from any of the government / semi government / private organization / firm / agencies / department etc.

Clause-34: Envelops: The contractor must submit Original + One copy of the complete bid document in separate envelops along with BoQ. These two envelops further enclosed in one envelop.

Clause-35: Defect Liability Period: All such intermediate payment shall be regarded as payments by way of advance against the final payment only and not as payments for work done and completed and shall not preclude the Engineer-in-charge from recoveries from final bill and rectification of defects and unsatisfactory items of works pointed out to him during defect liability period. Defect Liability Period at least 3 months after completion of the work.

Clause-36: Site Visit: The bidders are advised to visit and examine the Site of the works and its surroundings and obtain for themselves all information that maybe necessary for preparing the bid and entering a contract for the Works.

Clause-37: Verbal Instruction(s): No verbal instruction(s) / order(s) will consider valid. Any alteration/deletion/addition will only be considered if provided in writing by Project Director / HVAC Engineer.

Clause-38: Limit of Retention Money: Limit of retention money shall be 10% of the contract price stated in the Letter of Award.

Clause-39: Payment of Retention Money:

a) Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money shall be certified for the payment.

b) Upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified for payment to the Contractor.

Clause-40: Completion Time: 120 days from issuance of LoA.

Clause-41: Conditional / Optional / Alternate Bids: Such bids will not be accepted.



SECTION – 02

SPECIMEN GUARANTEES, ETC

GENERAL CONDITION OF CONTRACT

THIS AGREEMENT is executed at SUKKUR, on this day _____ of 2025.

BETWEEN

M/s Sukkur IBA University, Sukkur through its Project Director, located at Main Campus, Nisar Ahmed Siddiqui Road, Sukkur, hereinafter called and referred to as “SIBAU” (which expression shall wherever the context so permits, be deemed to include its legal representatives, executors, successors, and assigns) of the FIRST PART.

AND

M/s _____, having its office at _____, hereinafter referred to as “THE CONTRACTOR” (which expression shall wherever the context, so permits be deemed to include its legal representatives, executors, successor and assigns), through its proprietor _____, holding CNIC No. _____ on the SECOND PART.

WHEREAS “SIBAU” intends to obtain the work of Supply & Installation of HVAC System and Ancillary work for Academic Block-V related jobs/works as assigned in accordance with the tender PROC/EPADS/31/2024-25 at SIBAU Main Campus at the cost of Rs. _____ **Inclusive all taxes.** The basis with the works/jobs of items as per tender PROC/EPADS/31/2024-25 (SIBAU requirement) discussions in respect of the same as per determination of scope of works will be held with Project Director and “THE CONTRACTOR” have offered to render all kind of works/jobs (including but not limited to the “works/jobs mentioned in Work Order”) of the proposed works up to the satisfaction & handing over the project to the “SIBAU” having accepted the offer in finished form complete in all respect.

NOW IT IS HEREBY AGREED & DECLARED BY AND BETWEEN THE PARTIES AS FOLLOWS:

WITNESSETH

“SIBAU” hereby offer to appoint “THE CONTRACTOR” as their official work executor for the specific purpose of “Supply & Installation of HVAC System and Ancillary work for Academic Block-V” in respect of the same with “SIBAU” as per the determination of scope of works/jobs on suitable scale with any/all other relevant details for Supply & Installation of HVAC System and Ancillary work for Academic Block-V. “THE CONTRACTOR” hereby agrees to the offer the



“SIBAU” in acceptance of the terms & conditions here in below forth. However, the terms and conditions of the tender document PROC/EPADS/31/2024-25 would be an integral part of this agreement.

1 Article I
DUTIES & SCOPE OF WORK & AGREEMENT

- 1.1** This Agreement includes, the “services & works”, discussions with “SIBAU” as per determination of scope of services, schedule of work & timeline to suitable scale with any/all other relevant details to “SIBAU”.
- 1.2** “THE CONTRACTOR” agrees to provide any/all kind of services related to execution of work/job to “SIBAU” whenever and wherever is required as per the terms & conditions of this Agreement.
- 1.3** “THE CONTRACTOR” will coordinate for required/assigned works/jobs/project with HVAC Engineer / PD, of the “SIBAU” who will advise “THE CONTRACTOR” in supervision of proposed works/jobs related.
- 1.4** “THE CONTRACTOR” is bound to provide items including machineries, equipment, goods material, gadget, and manpower according to the Work Order.
- 1.5** It will be responsibility of the Contractor to remove debris/sludge/garbage/waste material/left over material, machineries, equipment, and manpower from the site at their own cost after completion of works/jobs/project. However, Clearance Note / Certificate will be required from Project Director.
- 1.6** Any additional work/job, if required / necessary etc. over and above/extra the Work Order, will be executed based on Variation Order.
- 1.7** Supply & Installation of HVAC System and Ancillary work for Academic Block-V, as assigned in accordance with the tender PROC/EPADS/31/2024-25.
- 1.8** Entry & Endorsement in the Measurement Book for all jobs done is mandatory. The Measurement Book is to be countersigned by HVAC Engineer & Project Director on each occurrence / daily basis.
- 1.9** The Contract will require to obtain Entry Pass of their employee/labor/manpower etc. from SIBAU, Security Office.
- 1.10** Any alteration/deletion/addition will only be considered if provided in writing by the Project Director. No verbal instruction(s) / order(s) will be considered valid.



2 Article II
SCOPE OF PROFESSIONAL SERVICES & WORKS

- 2.1 “THE CONTRACTOR” hereby agrees and acknowledges for the periodic supervision of the works and to check the execution of works in accordance with the Description & Specification mentioned in BoQ vide Tender PROC/EPADS/31/2024-25.
- 2.2 “THE CONTRACTOR” hereby agree and acknowledge the acceptance of attending the meetings with the Project Director “SIBAU” as & when required.
- 2.3 Date of Completion of work/job/project is__, 2025.
- 2.4 Physical inspection will be carried out by SIBAU authority. The ordered material is subject to final inspection at the time of delivery.
- 2.5 All staff must have CNIC and clearly mentioned to discourage work through child Labor.

3 Article III
REMUNERATION

- 3.1 The cost offered by the Contractor is Rs. _____ (inclusive of all taxes) vide tender PROC/EPADS/31/2024-25.
- 3.2 This Agreement includes, the “Supply & Installation of HVAC System and Ancillary work for Academic Block-Vs”, as per “SIBAU” requirement mentioned in Tender BoQ.
- 3.3 Payment will be made after completion of work/jobs/project and submission of bill/invoice. Clearance Note / Certificate from Project Director is required before processing bill/invoice.
- 3.4 A successful bidder should provide 10% Performance Security of the total value of the Work Order in the form of a Pay Order or bank guarantee after acceptance of the Work Order.
- 3.5 All Government taxes (including Income tax and E-stamp duty), levies and charges will be charged as per applicable rates / denomination of Purchase / Work Order.
- 3.6 E-Stamp duty as per Sindh Government rules for Services against total value of Work Order will be levied accordingly.
- 3.7 All rules, regulations and policies will be governed in accordance with the SPPRA & SIBAU PP&P.
- 3.8 Tax(es)/Challan(s)/Levy(ies), if any or additional will be paid/borne by Contractor as per SRO/Notification.



- 3.9 2% liquidated damages of the total amount will be imposed per month for which the company/firm/agency failed to complete work within the delivery/execution period and maximum up to 10%.
- 3.10 SIBAU will not pay any charges(s) regarding cartage / carriage / transportation / food / wages / accidental etc.

4 Article IV ARBITRATION

- 4.1 In case of any dispute, difference or and question which may at any time arise between the parties hereto or any person under them, arising out in respect of this letter of intent or this subject matter thereof shall be referred to the Project Director of the SIBAU and CEO of the "THE CONTRACTOR" for arbitration/settling of the dispute, failing which the decision of the court law in the jurisdiction of Sukkur binding to the parties. The Arbitration proceedings will be governed by the Arbitration Act, 1940 and the Substantive and procedural law of Pakistan. The venue shall be Sukkur.

5 Article V TERMINATION

- 5.1 "SIBAU" may terminate this agreement if the job is not executed according to the requirement at any time after issuing a 15 days' notice.
- 5.2 SIBAU reserves the right to accept or reject any or all agreement(s) or terminate proceedings at any stage in accordance with the rules & regulations in the relevant SBD notified framed by SPPRA.

6 Article VI INDEMNITY

- 6.1 "THE CONTRACTOR" in its individual capacity shall indemnify and keep SIBAU and any person claiming through SIBAU fully indemnified and harmless from and against all damages, cost and expenses caused to or incurred by "THE CONTRACTOR", as a result of any defect in the title of SIBAU or any fault, neglect or omission by the "THE CONTRACTOR" which disturbs or damage the reputation, quality or the standard of services & works provided by "SIBAU" and any person claiming through the SIBAU.

7 Article VII NOTICE

- 7.1 Any notice given under this AGREEMENT shall be sufficient if it is in writing and if sent by courier or registered mail.



8 Article VIII
INTEGRITY PACT

- 8.1** Its intention not to obtain the work of any contract, right, interest, privilege, or other obligation or benefit from the SIBAU or any administrative or financial offices thereof or any other department under the control of the SIBAU through any corrupt practice(s).
- 8.2** Without limiting the generality of the forgoing the contractor/ manufacturer / supplier / distributor represents and warrants that it has fully declared the charges, fees, commission, taxes, levies etc., paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within the SIBAU directly or indirectly through any means any commission, gratification, bribe, gifts, kickback whether described as consultation fee or otherwise, with the object of obtaining or including the procurement or service contract or order or other obligations whatsoever from the SIBAU, except that which has been expressly declared pursuant hereto.
- 8.3** The contractor/ manufacturer/supplier/distributor accepts full responsibility and strict liability for making any false declaration/statement, not making full disclosure, misrepresenting facts, or taking any action likely to degrade the purpose of declaration, representation, and warranty. It agrees that any contract/order obtained the aforesaid shall, without prejudice to any other right & remedies available to SIBAU under any law, contract, or other instrument, be stand void at the discretion of SIBAU.
- 8.4** Notwithstanding any right and remedies exercised by the SIBAU in this regard, manufacturer/supplier/distributor agrees to indemnify the SIBAU for any loss or damage incurred by it on account of its corrupt business practice & further pay compensation to the SIBAU in any amount equivalent to the loss of any commission, gratification, bribe, gifts, kickback given by the contractor / company / firm / supplier / agency / service provider as aforesaid for the purpose of obtaining or inducing procurement/work/service or other obligation or benefit in whatsoever from the SIBAU.

9 Article IX MISCELLANEOUS

- 9.1** Works/job/project will be handed over by the “SIBAU” or vet the cost with authentic stamp and signature.
- 9.2** Competent Authority reserves the right to change / alter / remove any item or reduce / enhance quantity without assigning any reason.
- 9.3** The terms and conditions of the AGREEMENT have been read over to the parties which admit to being correct and abide by the same.
- 9.4** The validity of the contract will be effective from the date of issue of the Work Order.



- 9.5** All terms and conditions of tender PROC/EPADS/31/2024-25 will be an integral part of this agreement and can't be revoked.
- 9.6** Any additional work/job, if required / necessary etc. over and above/extra the Work Order, will be executed based on Variation Order.
- 9.7** Entry & Endorsement in the Measurement Book for all jobs done is mandatory. The Measurement Book is to be countersigned by the Engineer & Project Director on each occurrence / daily basis.

It is hereby certified that the terms and conditions have been read, agreed upon and signed.

M/s _____

Contact Person: _____

Address _____

Tel # _____ Fax # _____

Mobile # _____ CNIC # _____

E-mail: _____

Stamp & Signature



PERFORMANCE SECURITY

SUKKUR IBA UNIVERSITY

GUARANTEE NO.: _____

DATE: _____

SUKKUR

AMOUNT: RS _____

EXPIRY DATE: _____

THIS BOND is executed at _____ on this ____ day of ____ 2025 by _____, having its registered Office at _____ (hereafter called the "Surety" which expression shall include its successors and assign) and M/S _____, whose registered Office is _____ (hereafter called the "Contractor" which expression shall include its successors and permitted assigns) in favor of Sukkur IBA University, Sukkur hereafter called the "Employer" which expression shall include its successors and permitted assigns).

WHEREAS the contractor by an agreement which shall be signed between the employer of the one part and the contractor of the other part (hereafter called the "Contractor" has agreed commissioning, adjusting, balancing & maintenance of certain works as therein mentioned viz Sukkur IBA University (hereafter called the "Works" in conformity with the precisions of the said contract.

AND WHEREAS one of the conditions of entering into contract Agreement is that the contractor shall provide to the Employer a performance Bond in the sum of Rs. _____ (Rupees _____) for due fulfillment of the contract.

AND WHEREAS, the surety has agreed to give to the employer this performance Bond on the terms and conditions mentioned hereinafter.

NOW THEREFORE, THIS BOND WITNESSETH:

1. That the contractor shall duly perform and observe all the terms, provisions, conditions, stipulations, and his obligations contained in the contract according to the true purport, intent and meaning thereof or as may be determined by the Employer who shall be the Sole Judge in the matter.
2. In the event of default being committed by contractor of which the Engineer shall be the sole exclusive Judge, the surety shall satisfy and discharge within three days after demand of all the damages sustained by the employer on account of the default of the contractor, as may whatsoever to the contractor and without any question whatsoever and whether or not the contractor disputes his liability in respect thereof and whether or not any arbitration or occur case is pending in respect of dispute.
3. That the liability of the surety under this performance Bond shall be up to the amount Rs. _____ /-(Rupees _____) and this Bond shall become null and void if the contractor has carried out the works and also performed his



obligation strictly in accordance with the contract to the full satisfaction of the engineer, who will be sole and exclusive judge to determine whether or not the contractor has carried out the works and fulfilled his obligation in accordance with the contract.

4. The Engineer can complete that portion of the work which the contractor has not commenced or not satisfactory executed, up to the amount of the performance Bond, at the Expense of the surety.
5. No alteration in the term of the said contract made by agreement between the Employer and the contractor or in the extent or nature of the works to be executed there under and no allowance of time by the Employer or the Engineer under the said contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning the said contract on the part of the Employer or the Engineer shall in any way release the surety from any liability under this Bond
6. That the payment under this Bond shall be made by surety in the name of the Employer and receipt issued by the Employer shall discharge surety from his liability to the Employer under this Bond.
7. That any notice or demand under this Bond may be made by the Employer and may be left at surety address mentioned herein or at any changed address as may be communicated by Surety to the Employer in writing against receipt of the Employer, or the said notice of demand may be sent by registered post Surety addressed as afore said and shall be deemed to have been at the time when it should have been delivered in due course of the post and a corticated signed by the Employer that the envelope containing the notice was posted shall be conclusive.
8. Our obligations under this guarantee shall always within the validity period of this guarantee does not exceed the Guaranteed Amount of Rs. _____ /- (Rupees _____) and that this guarantee shall remain valid up to **xx-xx-xxxx**. Claim of outstanding dues if any, under this guarantee must be received by us during business hours on or before **xx-xx-xxxx**. Should we receive no claim from you on or before **xx-xx-xxxx**, our liability under this guarantee will become null and void whether this original Guarantee is returned to us or not.

Signed, Sealed, and delivered

BY _____

For and on behalf of

(Surety)

In the presence of

Name: _____

Signed, Sealed, and delivered.

BY _____

for and on behalf of

(Contractor)

in the presence of

Name: _____



MOBILIZATION ADVANCE GUARANTEE

Guarantee No. :
Date :
Amount :
Expiry :
Contract :
Contractor :
Surety :
To :

Whereas M/s _____ having business address _____ (hereinafter called the "Contractor") having entered into an agreement (the "Contract") with you M/s Sukkur IBA University (hereinafter called the "Owner") for the work " _____ at Sukkur IBA University" .

AND WHEREAS the Procuring Agency has agreed to advance to the Contractor, at the Contractor 's request, an amount of Rs. _____ Rupees _____) Which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS the Procuring Agency has asked the Contractor to furnish Guarantee to secure the advance payment for the performance of his obligations under the said Contract.

AND WHEREAS _____ (Scheduled Bank) (hereinafter called the Guarantor) at the request of the Contractor and in consideration of the Procuring Agency agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW THEREFORE the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above-mentioned Contract and if he fails and commits default in fulfillment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Procuring Agency for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Procuring Agency shall be the sole and final judge, as aforesaid, on the part of the Contractor, shall be given by the Procuring Agency to the Guarantor, and on such first written demand payment shall be made by the



Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall come into force as soon as the advance payment has been credited to the account of the Contractor.

This Guarantee shall expire not later than _____ by which date we must have received any claims by registered letter, telegram, telex or telefax.

It is understood that you will return this Guarantee to us on expiry or after settlement of the total amount to be claimed hereunder.

Guarantor (Scheduled Bank)

Witness:

1. _____

1. Signature: _____

2. Name: _____

(Cooperate Secretary seal)



INTEGRITY PACT

Declaration Of Fees, Commission, and Brokerage etc. payable by the Suppliers/Contractors/Consultants.

M/s: _____, the contract hereby declares that:

Its intention is not to obtain or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Sindh (GoS) or any administrative subdivision or agency thereof or any other entity owned or controlled by it (GoS) through any corrupt business practice(s).

Without limiting the generality of the foregoing the Supplier/Contractor/Consultant represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit, in whatsoever form the Sukkur IBA University, except that which has been expressly declared pursuant hereto.

The Supplier/Contractor/Consultant certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with Sukkur IBA University and has not taken any action or will not take any action to circumvent the above declaration, representation, or warranty.

The Supplier/Contractor/Consultant accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts, or taking any action likely to defeat the purpose of this declaration, representation, and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other right and remedies available to Sukkur IBA University under any law, contract, or other instrument, be voidable at the option of the Sukkur IBA University.

Notwithstanding any rights and remedies exercised by Sukkur IBA University in this regard, the Supplier/Contractor/Consultant agrees to indemnify the Sukkur IBA University for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to Sukkur IBA University in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by Supplier/Contractor/Consultant as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit, in whatsoever form, from Sukkur IBA University.



Note: This integrity pact is mandatory requirement other than auxiliary services / works.

Sukkur IBA University

Stamp & Signature
Supplier/Contractor/Consultant



SECTION-03

TERMS OF PAYMENT

A. TERMS OF PAYMENT

1. ALL ADVANCE PAYMENTS SHALL BE MADE AGAINST FURNISHING THE **BANK GUARANTEE** IN FAVOR OF IBA SUKKUR UNIVERSITY IN REQUIRED FORMAT FROM ANY SCHEDULED BANK REGISTERED IN PAKISTAN.
 - i) Mobilization Advance 10% (Total amount)
 - ii) Upon delivery of the material / equipment at Site subject to confirmation of the Quantities delivered, specifications, Acceptance of Engineer In charge (SUKKUR IBA UNIVERSITY) 30%
 - iii) Balance Payment shall be made against Running Bills which will be jointly scrutinized by the Engineer In charge (SUKKUR IBA UNIVERSITY)
2. Payments against Clause (ii) and (iii) shall be subject to an adjustment / deduction of 10% Mobilization Advance (up to the complete recovery) and 10% Retention Money.
3. 10% Performance Bond shall be released after satisfactory completion of Maintenance Period (i.e. 12 Months after commissioning of the System)
4. Retention Money shall be released as follows:
 - (a) One Month after issuance of Completion Certificate 50%
 - (b) After satisfactory completion of Maintenance / Warranty Period 50%

B. PENALTIES

1. In case of delay in work the Client shall have the right to impose the Liquidated Damages as compensation @ 0.1% of the total cost of the tender per day. (Up to maximum 10% of total cost of works) after which client reserves the right at its Sole Discretion to rescind the Contract and take the action as per Contract Agreement. Performance Bond & Earnest Money shall be forfeited without reference to the Contractor. The Contractor may not be allowed to participate in future tenders with client.
2. If the delivered Material / Equipment does not comply with the specifications or have any missing item or received in damaged / defective condition, Contractor shall rectify / make the System in good condition at his own expenses whatsoever without voiding the Manufacturer's Warranty (if any) within a period of 1 Week (Period shall be accorded by client) after which CLIENT reserves the right in its Sole Discretion to



terminate the Contract and confiscate the Supplied Equipment along with forfeiture of Performance Bond without reference to the Contractor



SECTION - 04

SPECIAL CONDITIONS OF CONTRACT

01. GENERAL CONDITIONS OF CONTRACT

- 1.1 The General Conditions of Contract shall be carefully studied by each tenderer before submitting his tender. Nothing stated herein shall waive any part of the General Conditions of Contract unless specifically stated herein. Where clauses of General Conditions of Contract are repeated in this section, it shall be only for calling special attention to them and/or as a further qualification, and it shall not mean as omitting any other clause or clauses of the General Conditions of Contract.

02. SCOPE OF WORK

- 2.1 The accompanying specifications and drawings are intended to provide complete Air Conditioning systems and ancillary works for the Building referred in the specifications and drawings, and the contract on lump sum cost basis is intended to provide all materials and labour necessary for manufacture, supply, construction, assembly, installation, completion, testing, commissioning, balancing and adjusting and maintenance of the complete Airconditioning systems and ancillary works, making them ready for operation in all respects and training of the Employer's personnel.
- 2.2 (a) The general scope of work is detailed and shown in the specifications and drawings. Furthermore, included are all interconnecting piping, valves and fittings and electric wiring between and for various items of plant, equipment, controls and accessories.
- (b) Owner shall supply to the contractor, free of charge at site, certain equipment and materials as listed in the Schedule of Quantities. The contractor shall take delivery of these items, arrange careful storage and carry out assembly, installation of these items along with other items to be supplied by the Contractor so as to complete whole of the works in all respects as detailed in the specifications, drawings, schedules carefully study the specifications, manufacturers technical bulletins and drawings for the Employer supplied items so as to become fully familiar with the same for carrying out the works.
- 2.3 Within the general scope of work the following items are specifically included without limitation:
- a. VRF system
 - b. Refrigerant & Air distribution system
 - C System automatic controls
 - d. Water drain system for all equipment
 - e. All cutting, chases and making of opening and subsequent repairs except beam and slab openings.



- f. Motor Control Centers and complete electric wiring and earthing for all the plants, equipment, automatic controls and safety devices from electric supply and earthing points provided by the Employer as shown in the drawings. The Contractor shall also supply starters etc. for all Owner supplied equipment.
- g. Painting of equipment and system components and all other incidentals to make the exhaust air systems and ancillary works installation complete and perfect and ready for operation in every respect.
- h. Commissioning, testing, balancing, adjusting, painting and all other incidentals to make the Airconditioning, Ventilation and other systems and all ancillary works installation complete and perfect and ready for operation in every respect.
- I Adjusting and balancing of the complete air and water systems and automatic controls. The Contractor shall arrange the services of approved Specialist(s) for final balancing of the air exhaust system. The Contractor shall be responsible to provide the services of Engineers, technicians and skilled helpers as required by the Specialist(s) for carrying out the work.
- J Test runs of the complete system after the completion of installation, commissioning, balancing and adjusting of equipment and systems.
- K Servicing and maintenance of the complete plants during the period of maintenance (12 operating months).

- 2.4 The Contractor shall give written guarantee that all the equipment and materials supplied under the contract shall be brand new, of robust construction and standard manufacture, and that the materials and workmanship will be of best class, will be installed in a practical and first class manner, that the plants and systems will be complete for satisfactory operation, nothing being omitted by way of labour and material required to make them so although not specifically shown or mentioned in the drawings or specifications, and that these will be delivered to the Employer in well working order, complete and perfect in every respect.
- 2.5 The Contractor shall furnish all the required equipment, plants, devices, controls, etc. required to complete the works under applicable local codes or regulations required to complete the works.
- 2.6 The specifications are to be read in conjunction with the latest relevant British/American Standard Specifications and British/American Standard Codes of Practice. It shall be inherent in the interpretation of the contract documents that wherever British Specifications or Codes are referred to, they shall be deemed to be the British or American Standard Specifications or Codes and vice versa. Where differences or contradictions appear to arise between the British and American Standard Specifications or Codes, these differences or contradictions shall be referred to the Engineer for a decision.
- 2.7 In case any item or material offered deviates from the above standards, the tenderer shall clearly draw attention to all such deviations and no such item or material shall be supplied by the Contractor without prior written approval of



the Engineer.

- 2.8 The Contractor shall execute the works with materials in accordance with the specifications. All materials which in the opinion of the Engineer are not sound and/or do not meet with the above conditions, shall be immediately dismantled and/or removed from site by the Contractor at the request of the Engineer and replaced by appropriate approved materials without claim by or extra payment to the Contractor.
- 2.9 The tenderer shall carefully check the sizes of the plant rooms, the pipe and duct passages and trenches, the pipe and duct shafts as shown in the drawings and confirm that his equipment, piping, ducting, wiring, etc. can be installed within the respective spaces allocated for the same.

03. **RESPONSIBILITIES OF THE EMPLOYER AND CONTRACTOR**

- 3.1 The Employer shall not provide any equipment, stores, materials, etc. to the Contractor for the purpose of completing the works or temporary works except where otherwise specified in the contract.

The respective responsibilities of the Employer and the Contractor for the ancillary work shall be as detailed below.

3.2 Builders Work.

- (a) The Employer shall arrange all slab, beam and structural openings.
- (b) All wall openings, cutting, chases, patching and making good shall be done by the Contractor. Only finishing and painting shall be arranged by the Employer after the Contractor has completed his work.
- (c) All foundations for equipment mounting, MS Channels etc. will be constructed arranged by the Contractor who will also provide vibration isolators for isolation from the building structure as required (and/or specified).
- (d) The Contractor will supply and fix all necessary foundation and anchor bolts, concrete inserts, sleeves, brackets, clips, supports, stays, hangers, and hardware required for the complete installation. The Contractor shall supply and fix foundation and anchor bolts, concrete inserts and pipe sleeves before concreting. The Contractor will also be responsible for plugging of slab, wall and ceiling openings for all items and fittings where plugging must be done by special plugs, screws or materials.
- (e) The Contractor shall arrange for lifting of all equipment and materials (including Owner supplied equipment) to their respective plant rooms and locations. The Contractor will be responsible for any damage to the building finishing. He shall ensure that no damage is caused to the structure.

3.3 Electrical Work.



- (a) The Contractor will be provided with electric supply points, 400 volts, 3 phase, 4 wire along with two earthing points, or 220 volts, 1 phase with one earthing point, in the plant room as shown in the drawing.
- (b) The Contractor shall be responsible for supply and installation of the Motor Control Centers and complete electric wiring and earthing work for all system, equipment and automatic control. He shall also check and confirm that the specified ratings of the supply point meet the requirements of his plant and equipment.
- (c) The responsibility of the Employer would be limited to providing the electric supply point and earthing points as detailed above and shown in the drawings.

3.4 Decorating Work.

The Contractor shall not be responsible for the decoration of the building including false ceiling/boxing and any special decorative painting to the plant components visible in the occupied areas unless otherwise specified. The Contractor will be responsible otherwise for painting all equipment, plants, components, piping and ducting as specified.

- 3.5 The Employer will arrange without charge the Contractor, the supply of electricity, water and fuel during the commissioning, starting, testing and adjusting of the complete plant and during the Test Run. The Contractor shall be responsible for the supply of all other materials and labor required in this connection.

- 3.6 It will be the responsibility of the tenderer to clearly mention in detail any other particular work excluded by him in his tender but necessary to complete the work in all respects for satisfactory, efficient and trouble-free operation.

04. **COORDINATION**

- 4.1 The Contractor shall acquaint himself fully with the requirements of the program of Building construction and the requirements of the Main Contractor, Electrical Contractor, Plumbing Contractor and any other Contractor carrying out the work in the building. It would be necessary due to the nature of the air-conditioning work to arrange a proper sequence of installation with respect to the work of the other contractors. It shall be the responsibility of the Contractor to schedule his work to complete the air-conditioning installation work within the required time and without causing delay in the completion of the entire project.

05. **GUARANTEES**

- 5.1 The Contractor shall guarantee the performance (including specified capacities), fuel and electricity consumption of the plant and equipment offered by him. He shall state in his tender the natural gas/fuel oil consumption in cubic feet/litres per hour per horsepower of the boilers, KW consumption of



electric motor operated compressors/chillers/air conditioners and other equipment offered by him. The Contractor shall establish the performance, fuel and electricity consumption of the plant and equipment during the summer and winter test runs and will make all necessary adjustments to ensure that the performance and consumption is within the limits guaranteed by him.

- 5.2 The Contractor shall give to the Employer a written guarantee for the complete works against defective materials and faulty workmanship for the period of maintenance as specified in the Memorandum from the date of issue of Certificate of Substantial Completion by the Engineer. The guarantee shall also cover the maintenance of inside temperature and humidity conditions as specified. All defects of material or workmanship found in the work during the period of maintenance shall be removed and defective items replaced or repaired by the Contractor to the satisfaction of the Engineer without any additional cost to the Employer.
- 5.3 The Engineer shall inform the Contractor in writing what respect for any portion of the work, plant or equipment is defective. If any defect is not remedied within reasonable time by the Contractor, the Employer may proceed to do the defect rectification work at the Contractor's risk and expense but without prejudice to any other rights which the Employer may have against the Contractor in respect of such defects.
- 5.4 In case the replacements, repairs or renewals are of such a character as may affect the efficiency of the plant or equipment, the Engineer shall have the right to give to the Contractor within one month from such replacements, repairs or renewals notice in writing that a test be carried out to check the efficiency and performance of the plant or equipment and it shall be the duty of the Contractor to ensure that the efficiency and performance of the plant or equipment conform with the specified requirements.
- 5.5 In the event of any defect of material or workmanship occurring or being discovered during the period of maintenance, the period of maintenance shall continue until the cause of the defect has been discovered and remedied to the satisfaction of the Engineer.

06. **MANUFACTURERS/SUPPLIERS' GUARANTEES/WARRANTIES**

- 6.1 Manufacturer/Supplier's Guarantee/Warranty, specimen given below, for each equipment is an essential document to be supplied to the Employer before claiming payment for that equipment. The Guarantee/Warranty shall be duly sealed and signed by an authorized Executive of the Manufacturer/Supplier.
- 6.2 (a) The Contractor may obtain the Guarantee/Warranty from the Manufacturer/Supplier and submit the same to the Engineer/Consultant before claiming payment for the equipment on his bill, or



- (b) The Manufacturer/Supplier shall furnish the Guarantee/Warranty as an essential part of the documents submitted to the Bank to claim payment against the letter of credit established by the Employer.

6.3 The form of Guarantee/Warranty shall be:

"We hereby guarantee that the stores supplied are produced newly in accordance with the contract specifications and that the materials used whether or not of our manufacture are in accordance with the latest appropriate standard specifications, the contract specifications and of good workmanship throughout. We shall replace free of cost FOB Factory or repair any part of the equipment for either a period not exceeding 12 calendar months after it has been taken over on completion of installation as certified in the Completion Certificate issued by the Employer or a period of 24 calendar months from the date of dispatch from our Factory, whichever is shorter, which would be found defective due to material or faulty workmanship or in any way not in accordance with the contract specifications.

Our responsibility shall be limited to replace/ repair any part or parts of the stores found to be defective in workmanship or material provided the equipment is operated and maintained by the Employer in accordance with the generally approved practices and provided the Employer informs us in writing as soon as such defect becomes apparent.

Our obligation shall be to replace or repair any part or parts found defective FOB Factory and we shall not be responsible for any consequential damage or liability. We shall also not be responsible for any work done, equipment or part(s) supplied or repaired by others or for any loss, damage or expenses arising from such work, equipment, part(s) or repairs.

Signature and Seal _____

Manufacturer/Supplier's Name and

Address _____

Date _____ "

- 6.4 Wherever guarantees of operating capacity and efficiency, proper functioning, durability and the like are called for and/or wherever it is specified that the manufacturer shall furnish necessary technical manuals, drawings, performance data, test certificates, etc. and shall supervise the starting up of the equipment and adjustments after installation and starting up, and etc., and maintain it for the required period and perform similar other duties and services, the Contractor shall be held responsible for performance of the



specified services for the actual conditions of the installation and he shall be held responsible for any default on the part of his suppliers/manufacturers/principals.

07. DRAWINGS, TECHNICAL DATA AND MANUALS TO BE SUPPLIED

- 7.1 The Contractor when preparing any detailed shop drawings shall carefully check for all clearances, field conditions, avoidance of any hindrance with architectural features and proper coordination with all other services of the building. Each shop drawing submitted by the Contractor shall include a certificate by the Contractor that all related conditions on the site relevant to that installation have been checked and that no conflict exists. The Engineer/Consultant shall not approve any shop drawing submitted by the Contractor without such a certificate.
- 7.2 Manufacturers' performance data, performance and other test certificates and shop drawings for all main equipment giving complete information regarding dimensions, materials and other details confirming the adequacy of the equipment to be supplied shall be submitted to the Engineer/Consultant for approval.
- 7.3 All shop drawings etc. correct and conforming with the contract requirements, shall be submitted to the Engineer/Consultant sufficiently in advance of actual requirements to allow ample time for checking and approval and no claim for extension of the contract time will be considered by reasons of the Contractor's failure to submit the correct drawings etc. in time. The Contractor will submit eight copies of final corrected shop drawing for approval out of which 3 duly approved copies would be returned to him.
- 7.4 The Contractor shall clearly point out the differences, if any, between the details submitted and the requirements of the contract in covering letters sent with the submitted documents and drawings. He should also give reasons for his request for substitution so that if substitution is approved by the Engineer, necessary action may be taken for price adjustment. The Contractor will not otherwise be relieved of his responsibility for executing the works in accordance with the contract.
- 7.5 After completion of the installation work, the Contractor is to provide reproducible transparencies (quality to be approved by the Client) and 3 copies each of as installed drawings showing runs and location of all the plant, equipment, controls, piping, ducting, electric wiring, buried work, etc. giving all necessary details of the works as actually installed.
- 7.6 Technical Manuals.
- The Contractor shall supply seven sets of printed manufacturers' installation, commissioning, operation, servicing and maintenance manuals, technical catalogues and detail spare parts manuals in English language for all items well



before shipment of the items by the manufacturers/suppliers for the guidance of the Employer's operators in operation, servicing and maintenance of the plants and equipment.

- 7.7 In case of any question regarding the Contractor's responsibility for preparation and supply of any detail shop drawings, data, as-installed drawings, technical manuals, etc., the Engineer's decision shall be final and binding as to the requirements of the shop drawings, data, as-installed drawings, technical manuals, etc. for the works.
- 7.8 The approval by the Engineer of any submitted data, shop drawings, performance curves, test certificates for any item, arrangement and or layout shall not relieve the Contractor from any responsibility regarding the performance of the contract. Such approval shall not also relieve the Contractor from responsibility for error of any sort in the submitted data and shop drawings, etc.



SECTION – 05

TENDERER'S QUALIFICATION / EVALUATION CRITERIA

I. MANDATORY REQUIREMENTS BEFORE EVALUATION OF TENDER

- (a) Bidder must be registered with Pakistan engineering council (PEC'S Category C-3 Registered in Mechanical Engineering ME-01).
- (b) The Contractor /Bidders must be the sole distributor of the VRF equipment since last five Years (5Years) of the offered brand/system.
- (d) Income Tax Return / Audit Report for the Last 3 Years, Minimum turnover equal to or more than the estimated cost.
- (e) The Firms / Bidders / Suppliers blacklisted by any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.
- (f) The Firms / Bidders / Suppliers in litigation with any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.
- (g) The Firms / Bidders / Suppliers who have failed to perform as per Contract with the Government / Semi Government Organization will not be eligible to bid. Affidavit to be submitted.
- (h) Organization structure of the "Contracting Firm" (whether the firm is a partnership or Limited Company etc.
- (i) Programmer of work to ensure that the work will be completed within the stipulated time on the prescribed format.

NOTE. THE EVALUATION OF ANY THESE BIDDERS SHALL BE CARRIED OUT WHO WILL COMPLY WITH THE ABOVE PARAMETERS.

II. TECHNICAL EVALUATION OF TENDER

- A. It will be examined in detail whether the goods offered by the bidder comply with the technical provisions of the technical bidding documents. For this purpose, the bidder's data submitted with the bid will be compared with the specific work data prescribed by the Employer and technical, feature / criteria of the Goods detailed in the technical provisions. Other technical information submitted by the bidder regarding the scope of work will also be reviewed. In addition to this the following Technical Details / Requirement must be provided / complied with the Tender Documents (Technical Bid).



- B. Tender shall be rejected if it is non-submission of verifiable proof against the mandatory as well as general documentary, qualification and eligibility related requirements.

C. Technical Evaluation:

The firm cleared from initial screening will be evaluated as per the following criteria:
The total marks shall be 100. Minimum score for competing in the next stage is 70 %.
The Financial Proposal of only the Audit Firm will be opened which secures 70 % or more in the Technical Evaluation.

S.NO	DETAILS	POINTS
1	Pay Order / Draft of Earnest Money @ 2% of offered rate	Mandatory
2	Bid /Quotation (As per pattern)	Mandatory
3	Certificate of Registration in Pakistan Engineering Council PEC'S Category C-3 Registered in Mechanical Engineering ME-01).	Mandatory
4	Income Tax Registration	Mandatory
5	General Sales Tax Registration & Sindh Sales Tax Registration (SRB)	Mandatory
6	Proof of Non-Blacklisting: Affidavit on legal paper of appropriate value (duly attested from notary public)/letterhead that the Firms / Bidders / Suppliers blacklisted by any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.	Mandatory
7	The Contractor /Bidders must be the sole distributor/Authorized Distributor of the VRF equipment of the offered brand/system with verification letter & have Authorization letter for participation in this tender from the equipment supplier.	Mandatory
8	Income Tax Return / Audit Report for the Last 3 Years, Minimum turnover should be equal or higher from the estimated project cost	Mandatory
9	The Contractor/Bidders must submit the complete Technical Data / Catalogue of all offered Equipment, VRV, Split, Piping, Fans, Wires etc.	Mandatory
10	Technical Compliance Sheet Provide Technical Compliance Sheet in Tabulated Form specifying the compliance of each and every quoted item with minimum specification of required items mentioned in Bill of Quantity (BOQ) of this document.	Mandatory
11	Manufacturing Origin Details The Contractor / Bidder must provide details of the origin (Country) of the brand and country with city name of the manufacturing facility/Factory of the VRF equipment to be manufactured with allied accessories to be used in this project.	Mandatory
12	Annual turnover (Max Points 20) a. 300 to 400 million (10 Points) b. 400 to 600 million (15 Points) c. Above 600 million (20 Points)	



13	Sole distribution/Authorize Distribution of the VRF Equipment in Years (Max Points 10) a. Less than 5 Year (0 Points) b. 5 to 6 Year (8 Points) c. 6 to 8 Year (10 Points)	
14	No of similar nature of same or more than 500 TR capacity project in 5 Years. (Max Points 15) a. 5 Project (06 Points) b. 6 to 8 Project (10 Points) c. 9 to 11 Project (12 Points) d. 12 to 15 Project (15 Points)	
15	Total No of employees (Max Points 05) a. 40 Employees (3 Points) b. 50 to 60 (4 Points) c. 70 to 100 (5 Points)	
16	Complying with the Specification of HVAC System (VRV & Others) with 2 Years Warranty. (Max Points 30)	
17	EER value of Offered Outdoor Units (each Circuit) should be more than 4.0 @ AHRI Conditions Indoor 27/19 & Outdoor 35 degree ambient. (Max Points 10) a. EER more than 4.25 (10 Points) b. EER more than 4.0 (08 Points) c. EER less than 4.0 (00 Points)	
18	Warranty/Guarantee Terms. (Max Points 10) a. 2 Years' Service, Repair & Replacement Warranty (10 Points) b. Less than 2 Years' Warranty (00 Points)	

- a. Bids will be evaluated in fair, transparent and non-discriminatory manner. To determine the Most Advantageous bid, following the above mandatory scales of evaluation shall be taken into consideration for technical and financial bids.
- b. Failing to fulfill ANY of the Mandatory Requirement will disqualify the bidder from the process.
- c. After evaluation/marketing of bidders in technical evaluation process, financial bids of technically qualified bidders only will be opened later prior notice.
- d. For final grading of bidders towards contract award, Most Advantageous bid prices will be calculated to ascertain lowest bid for placement of procurement contract.

NOTE: Carefully review all requirements for the evaluation of the Technical Bid and ensure that all relevant documents are submitted along with the Technical Bid on EPADS. **Sukkur IBA University will not request any bidder to submit missing documents after**



the opening of the Technical Bid. Any bid that is found incomplete or missing any of the required documents at the time of evaluation **shall be rejected outright without any further correspondence or opportunity for resubmission.**

S. No.	Items	Approved Make
1	VRF/ Split	1. L.G 2. Daikin 3. York 4. Hitachi 5. Samsung 6. Hisense 7. Gree Approved Equal
2	Refrigerant pipes	1. Mueller (USA) 2. Trox Approved Equal
3	Pipe/Duct Insulation	1. Aeroflex 2. Aerofoam 3. Armaflex Approved Equal
4	UPVC Pipe	1. Dadex 2. AGM 3. Steelex Approved Equal
5	Electric Cables & Wires	1. Pakistan Cables Approved Equal
6	Ventilation/Air Curtains Fan	1. GreenHeck 2. BVN, Turkey 3. Sodeca, Spain 4. DynAir Approved Equal
7	G.I Sheet	1. Pakistan Steel 2. ISL 3. Imported Approved Equal
8	Air Devices	1. Steel Craft 2. Mehran 3. Thermec 4. EAP Approved Equal
9	Concrete Fasteners & anchors	1. Hilti (UK/Germany) 2. Fischers (Germany) 3. Index (Spain) Approved Equal

10	Paints	1. ICI (Pakistan) 2. Berger (Pakistan) Approved Equal
11	Motors	1- Siemens 2- ABB Approved equal
12	M.C.C & CABLE TRAY	1- Karimi Electric 2- Sunbeam 3- Husain & co. Approved equal
13	Refrigerant Isolation Valve	1- Danfoss 2- Mueller 3- Emersion Approved equal
14	Control wire	1- Belden Approved equal
15	Aluminum Tape	1-Abro industries (USA) Approved Equal
16	FILTER	1- CAMFIL 2- AMERICAN air filter Approved Equal
17	Vapor Barrier Coating	1. Foster (USA) Approved Equal

NOTE:

Equipment & material shall be supplied only by the authorized distributor. The contractor shall submit complete technical details of the equipment and material and obtain approval prior to delivery on site. in case of “approved equivalent”, it shall be at the discretion of the client to accept the alternate proposal submitted by the contractor.



SECTION-06

SPECIFICATION OF HVAC WORK

A. Basis of Design

Air conditioning and mechanical ventilation system have been designed to meet desired temperature, humidity at different locations of the building. Cooling load calculations have been suitably performed to meet peak loading time of whether profile. Highly efficient, air cooled Variable Refrigerant Volume (VRV) units are considered for all air-conditioned areas. Fresh air supply systems have been introduced into the building to create a comfortable environment to occupants. Indoor design conditions have been considered as follows.

VRV SYSTEMS

SPECIFICATION FOR VRF SYSTEMS

BASIC DESIGN

The mechanical services shall maintain the following conditions at the stated external parameters:

Internal design conditions

Summer 23⁰ C db, 50% RH

Winter 21⁰ C, 40% RH

External design conditions

Summer 45⁰ C db, 27.0⁰ C wb

Noise criteria

External noise criteria
At 1 m in front of the plant NR60

Design noise criteria
To the offices NR40



B. GENERAL DESCRIPTION

The building shall be air conditioned via Variable Refrigerant Flow System with R410A refrigerant based Multi Split Unit.

The systems shall comprise of one or a number of outdoor units connected via interconnecting refrigeration pipe work to multiple indoor units using simple Y, T or Header type branch pipe connectors. The systems shall be complete with all the necessary electronic controls board and control wiring to maintain the design room conditions without an external controller.

Installation

The equipment must be installed in line with the manufacturer's specification and design

standard as listed below:

Piping, Y, T or header distributor size and wiring sizes to be carried out as per manufacturers standard. However, the sizes in drawings are tentative and will be in the range of $\pm 10\%$ up or down. Supplier to submit computerized selection with schematics.

The warranty of the company will be TWO YEARS after submission of satisfactory commissioning report and evidence of a satisfactory test run of 30 days test/maintenance period.

1.1 Makes of Equipment Offered

Makes of equipment offered shall be commonly used in Pakistan and having a local agent possessing adequate workshop facilities, experienced technical personnel operating in Pakistan for a minimum of five years. Prior approval from the Engineer shall be obtained before placing the orders for the supply of equipment.

1.2 Scope of Work

The scope of work consists of supply and installation of Variable refrigerant volume (VRV) units, toilet exhaust system, ventilation system at proposed building complex.



The air conditioned areas are as per the relevant drawings attached with the tender document. All components permanent and of temporary nature shall be supplied, installed, tested and commissioned by the contractor.

FIRE RETARDANT

Fire retardant material and equipment, shall be installed in accordance with NFPA standard No. 90A, and No. 204.5 or as specified otherwise hereinafter.

VIBRATION & NOISE CONTROL

VIBRATION CONTROL

Minimize the transmission of vibration and noise from rotating or reciprocating equipment to other building elements, except for external equipment which is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

- For static deflections < 15mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment.
- For static deflections \geq 15mm: Spring mountings.

Select mountings to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

- Spring mountings Type:

Free-standing laterally stable springs with at least 12mm clearance between springs and other members such as bolts and housing.

- Characteristics:
 - Leveling bolts and lock nuts.
 - 5mm neoprene acoustic isolation pads between baseplate and support.
 - Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection, and which remain out of contact during normal operation. Set and adjust vibration isolation mounting supports to give adequate clearance for Free movement of the supports.
- Supports:
 - Support on vibration isolation mountings using height saving support brackets.

ACOUSTIC REQUIREMENTS

Internal acoustic insulation shall be provided for the ductworks at least 3m from or/and before equipment.

The internal acoustic insulation material for all ductworks shall be Irradiation (physically)



crosslink Closed cell polyolefin foam (IXPE) with factory applied reinforced Aluminium foil and self-adhesive backing. The material must be assured comply with antifungal Zero Growth of ASTM G21 and total Volatile Organic Compound emission rate less than 0.05 mg/m2/hr (Low VOC<0.05). All insulation shall have the following physical properties:

- Thermal conductivity to JIS A1413 at 20°C, 50 – 70% RH: 0.032 W/mK max.
- Moisture permeability to ASTM E96 at 38°C, 90% RH: 9.26g/m2/s.
- Moisture absorption: Negligible
- Working temperature range: -80°C to +100°C.

VARIABLE REFRIGERANT VOLUME (VRV) SYSTEM

The Variable Refrigerant Volume (VRV) system shall be of the multi-zone modular split type with R407C or R410A refrigerants. The building is to be air conditioned by VRV system shall consist of one air-cooled outdoor condenser unit connected to a group of indoor fan coil units in one single refrigerant circuit. The indoor units shall be composed of wall mounted type, Four-way ceiling concealed cassette type and outdoor fresh air processing units. The outdoor unit shall not comprise more than three modules. The system shall utilize fully modulating electronic expansion valves.

The variable refrigerant flow system piping system shall be designed by a manufacturer's certified designer in accordance with the manufacturer's recommendations and as specified herein. The size of the refrigerant pipes shall be obtained from the equipment manufacturer unless otherwise shown on the drawings. If the employers design refrigerant pipe layout is not used, contractor shall submit fully revised piping layout to engineer, complete with revised locations. Revised piping layout shall be submitted prior to the equipment submittal for review and approval by the engineer. Revised piping layout shall not affect the performance of indoor or outdoor units.

The variable refrigerant flow piping system shall be installed by a skilled labour who specially trained for refrigerant pipework installation. The refrigeration piping system shall be supplied, installed, tested, evacuated, and charged by the contractor.

OUTDOOR CONDENSER UNITS

The outdoor unit shall be factory assembled, completely weatherproof and corrosion resistant. The outdoor unit shall be constructed from steel plate and treated with acrylic paint, or galvanized steel, finished with a powder coated baked enamel. The unit shall be completely factory wired tested with all necessary control.

All outdoor units higher than 56kW of cooling capacity shall have minimum 2 scroll compressors and be able to operate even in case one of the compressors is out of order. It should also be provided with duty cycling for multiple Inverter/Digital Compressor switching starting sequence of multiple modular. The outdoor unit shall be modular in design and shall be allowed for side-by-side installation. The unit shall be provided with to; microprocessor control panel. The outdoor unit shall have anti-corrosive steel plate for easy mounting of the unit.



Noise level shall not be more than 60 dB (A) at normal operation measured horizontally 1m away and 1.5m above ground. Control wiring from outdoor unit to indoor units shall be contractor's scope.

The compressor shall be highly efficient hermetic scroll type, capable of inverter control and Energy Efficiency Ratio (EER) of all Outdoor circuits shall be higher than 4 under AHRI conditions on indoor temperature of 27°CDB, 19°CWB and outdoor temperature of 35°CDB. It shall change the speed in accordance to the variation in cooling load requirement or the refrigerant volume through loading or unloading. All outdoor units shall have multiple steps of capacity control to meet load on fluctuation and indoor unit should have individual control. The system shall use a control sequence to ensure that indoor loads are matched to compressor capacity control. The outdoor unit shall have air cooled heat exchange coils constructed from copper tubing with aluminium fins.

The outdoor unit shall be interconnected to indoor unit types specified in the drawings. The indoor units shall be connected to the outdoor units utilizing the specialized piping joints and headers provided by the equipment manufacturer. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.

The system shall automatically restart operation after a power failure and shall not cause any settings to be lost, thus eliminating the need for re-programming.

The following safety devices shall be included on the condensing unit: high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, and over current protection for the inverter. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature. Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping length. High efficiency oil separator shall be fitted to the discharge side of the compressor together with factory filled oil equalization system.

The power supply to the outdoor unit shall be 400 volts, 3 phase, 50Hz. The condensing units shall be suitable to work on heating/cooling mode.

FEATURES FOR VRV

The VRV All DC Inverter system shall have the following features:

Variable-capacity compressors:

All compressors should be DC Inverter type compressor controlling the cooling and heating capacity automatically according to the load.

Only DC inverter compressor shall be used in this system and it can directly intake gas to reduce loss of overheat and improve efficiency.

High-efficient permanent synchronous motors are required, to get better performance than traditional D.C. inverter compressors.



Compressors shall have 180° Sine Wave DC Speed Varying Technology to satisfy various places' demands for different temperature and shall be able to save a great deal of electricity and provide users with utmost comfort at the same time.

The condenser fan motors shall be DC Inverter type and shall have Step less speed regulation ranges from 5Hz to 65Hz. Compared with traditional inverter motors, it shall be more efficient. It shall have Sensor less control technology to guarantee lower noise, less vibration and steadier operation.

In auto energy saving mode, system shall be able to self-adjust parameters according to the operation status, thus to lower the cost of electricity with up to 15% of energy saving. In compulsory energy saving mode, the system shall limit power output forcibly with up to 20% of energy saving.

System shall have automatic energy auto-allocation technology.

System shall be able to remember the highest temperature outdoors. When night comes, system shall automatically turn to quiet mode. There shall be an option of Quiet modes which can be set according to actual needs.

System shall also be able set in this mode to ensure low noise as long as unit is operating.

The indoor units of VRF all DC inverter system shall have DC Inverter motors to realize step less regulation. According to indoor temperature or people's actual needs, users shall set this mode through the indoor wire control.

The cooling or heating mode shall have option to be deactivated during a certain season to avoid the mode conflict in case of miss operation.

The outdoor unit shall be able to be linked with a fire alarm signal. In case of emergency, unit shall automatically turn off to avoid risk or further loss.

When a certain indoor unit needs to be repaired, it shall be powered off without any interruption to the system's operation.

The operating priority sequence of the outdoor unit modules shall be changed without restart when the system accumulatively operates for 12 hours, to maximize the service life of the system

Each module shall be an independent sub-system, and the whole system won't fail down even if partial malfunction occurs. Upon malfunction of any one of the modules, there shall be an option of emergency operation after simply manual setup on the outdoor PCB switches.

The system shall be without liquid receiver and the excess refrigerant will be stored in the piping, which would minimize the refrigerant charging volume and enhance the control accuracy of the refrigerant.

Based on the actual status of each unit and compressor, system shall regulate compressor's operation and realize oil balance.

Refrigerant shall be taken into a compressor by an intake pipe and then runs through the cooling system. It shall control oil level and the minimum oil each compressor need and therefore realize oil balance.



Dual electronic expansion valve shall precisely regulate refrigerant's flow between outdoor units and indoor units.

The best heating or cooling performance shall be realized in the most energy-saving way. DC inverter compressor and D.C. inverter fan will also be operating in this way to ensure high efficiency.

The VRV all DC inverter system shall realize a combination of 4 outdoor unit modules (maximum). When error is occurred to one of the modules, the others shall perform the emergency operation to sustain the air conditioning. All the compressors in each single module shall be DC Inverter based, when one compressor has error, others shall perform the emergency operation. Double-fan design shall ensure that one fan can still work even if the other one has error.

Outdoor unit fan shall have 4 levels of static pressure that can be set, when an outdoor unit needs to be placed indoors. The VRV all DC inverter system shall realize a combination of 4 models (maximum) and connect as many as 80 indoor units.

The cooling capacity of the outdoor units should adjust automatically, according to the number of operating indoor unit(s).

The maximum total pipe length should not be greater than 1000 m.

The maximum actual pipe length between indoor unit and outdoor unit should not be greater than 175m.

The maximum height difference between indoor unit and outdoor unit should not be greater than 90m.

The maximum distance between the first branches to the farthest indoor unit should not be greater than 40m.

The system should have an inner-screw copper heat-exchanger, which can create higher heat exchange efficiency and powerful heating capacity especially in low ambient temperature. Outdoor heat-exchange area should be adjusted by running load. The system should have dual EXV, which should adjusting precision to insure precise control of refrigerant and raise system circulation efficiency.

The combination of one main and one auxiliary four way valve should control the outdoor heat exchanger and outdoor air flow independently and according to the load, adjust the heat exchange volume of outdoor unit accurately and prevent wasting the capacity in part load time. Main 4-way valve should be used as the traditional 4-way valve, while the auxiliary 4-way valve should be used to adjust the heat-exchanger area of outdoor unit when in cooling mode.

The structure of the system and the piping work should be simple, so that the installation is easy. Each series of indoor units should have the same pipe dimension, and all the pipes should be connected by flare nut.

The system should have simple refrigerant piping system without any complicated maintenance work



CONTROLS:

The system should have Individual control, group control, network control options.

The system should have network control system that can realize intelligent management to the A/C system,

The system shall have auto debugging features like:

Automatically allocate ODU and IDU addresses

Automatically calculate numbers of ODU and IDU

Automatically detects errors;

Automatically starts debugging.

VRF Central Controller shall adopt communication technology.

FAN COIL UNITS

Each indoor unit has Electronic Expansion Valve which senses the temperature based on variation of the load and conveys the same for the outdoor modules to respond accordingly. The indoor unit shall be selected as per the dehumidified air flow rate at medium fan speed, sensible and latent cooling loads. Each unit shall have electronic control valve to control the refrigerant flow rate respond to load variations in the conditioned space.

The cooling / heating coil shall be made out of seamless copper tubes and have continuous aluminium fins. 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.

Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The power supply to the fan coil unit shall be 230 volts, single phase, 50Hz.

Wired wall mounted thermostats shall be used according to the application. Location of wired wall mounted thermostats are indicated as specified in the drawings where necessary.

CEILING MOUNTED TYPE CASSETTE INDOOR UNIT

The unit shall be ceiling concealed type. The unit shall include washable pre-filter, fan section and DX-coil section. The housing of the unit shall be with internally insulated galvanized sheet steel. Unit shall have an external attractive panel for supply and return air. Unit shall have four way or round shaped supply air grilles on sides and return air grilles at center.

Provide fresh air intake kit where used and indicated on the drawings and each unit shall have fresh air intake provision. All the units regardless of their differences in capacity should



have same decorative panel size for harmonious aesthetic point of view.

Fans shall be of the single inlet, with centrifugal forward curved wheels of reinforced glass fibres or rigid plastic material construction. Fan wheels shall be statically and dynamically balanced for true operation. Fans shall be direct driven by, three speed motor. Swing type louvres for directional airflow shall be provided for each supply air slot in each fan coil unit. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.

Each cassette type fan coil unit shall be equipped with a built-in high lift condensate drain pump and condensate drain pan. The condensate drain pan shall be of plastic or fiber, sufficiently insulated and pitched for positive drainage by the drain pump

PIPEWORK

REFRIGERANT PIPEWORK

The pipe work shall be of quality copper ASTM B280 for Air Conditioning and Refrigeration, DIN1754/8905 half hard tempered. Soft tempered pipe (Type-L)work may be used where the pipe diameter is 1/4" or 3/8". Above 3/8" all pipe shall be type-K.

Long radius bends shall be formed using pipe bender. The use of short radius pre formed bends and elbows should be avoided to minimize pressure drop and possibility of leaks.

Oxygen free nitrogen must be passed through the pipe work during all brazing of joints to prevent the formation of oxidization scale on the inside surface of the pipes.

All pipe work shall be clean, de-hydrated and sealed. Pipe work shall be stored under dry conditions. Any pipe work found to be stored without the end caps should be rejected. Where sections are cut from a new coil any remaining lengths must be re-sealed. During the installation if the system has to be left unattended for any purpose whatsoever, the openings in the systems must be securely sealed.

Pipe work fittings for branching off to indoor units must be Y, T or header type Branch joints as supplied by manufacture. No other fittings are acceptable like expansion Valve or devices. The positioning and installation of these joints shall be strictly in accordance to the manufacturer's specification.

All pipe work shall be insulated with foam insulation Class-0 type insulation, Minimum 19 mm thick. Joints and headers shall be insulated with the pre formed insulation supplied with these fittings. Insulation exposed to atmospheric conditions shall be externally protected with Fiber glass insulation complete with plastic paint and jacketing. All insulation joints shall be made using adhesive and care should be taken that the every part of insulation is sealed to maintain a vapour barrier.

The pipe work must be supported through its entire length according to good refrigeration practice. However the brackets must not be positioned directly on the joints or headers. On horizontal pipe work the bracketing should be over the insulation to allow pipe movement due to contraction and expansions. The vertical pipe work shall be bracketed at



no more than 1000 mm centres. The horizontal pipe work shall be bracketed at no more than 1500 mm centres.

The pipe work layout and the pipe sizing shall be approved and according to the manufacturer standard.

All installed pipe work lengths are to be accurately measured and recorded on the commissioning form. This information is required for accurate calculation of the additional refrigerant charge for the system. The weight of the additional refrigerant must also be recorded for future reference.

DRAIN PIPEWORK

The condensate from each fan coil unit must be directed to the closest possible location. The condensate piping shall be Type 600 PVC. Condensate piping shall be insulated with flexible closed cell elastomeric to prevent condensation. The exact path to be taken by the condensate piping is to be decided in consultation with the Architect and the Consultant.

CONTROLS (OUTDOOR UNIT)

The units shall be equipped with Auto Restart function, which allows the unit to start in the same mode prior to the power failure.

Digital thermostat: Units shall be controlled with user friendly, wall mounted microprocessor-based LCD, wired remote controller. The wired remote controller shall be slim having the following features.

- a) 24 hour ON / OFF timer in 1 hour interval.
- b) Test run mode.
- c) Self-diagnosis function.
- d) Operation indication.
- e) Room temperature display.
- f) Weekly programming.
- g) Child lock function.
- h) 3 speed fan control.
- i) Linear control of E.S.P/Airflow.

The wireless remote control should be available as an option, if required.

Computerized control shall be used to maintain a correct room temperature either at the fan coil or from a sensor in the remote controller. The system shall be equipped with a self-diagnostic feature for easy service and maintenance. The LCD remote controller shall be able to control up to 16 indoor units as a group. It shall also be possible to select cooling, heating, fan only or automatic change over mode for heat recovery systems.

CONTROLS (INDOOR UNITS)

Digital thermostat: Units shall be controlled with user friendly, wall mounted microprocessor-based LCD, wired remote controller. The wired remote controller shall be



slim having the following features.

- a) 24 hour ON / OFF timer in 1 hour interval.
- b) Test run mode.
- c) Self-diagnosis function.
- d) Operation indication.
- e) Room temperature display.
- f) Weekly programming.
- g) Child lock function.
- h) 3 speed fan control.
- i) Linear control of E.S.P/Airflow.
- j) Auto swing
- k) Clean filter indication

The wireless remote control should be available as an option, if required.

CONTROLS AND THERMOSTATS

WIRED REMOTE CONTROLLER

Wired remote controller unit capable of controlling the following functions of fan coil unit should be provided,

- Start/Stop of fan coil unit
- Fan Speed
- Air flow direction (If applicable)
- Temperature set point
- Operation mode and other thermostat settings
- Timer Setting and scheduling

MECHANICAL FANS

A successful be carefully selected and be entirely suitable for their particular service, position of fittings and chosen with respect to corrosion, in flammability or other hazardous application.

The fans shall be capable of handling the air quantity necessary for the specified system performance against the resistance of the system. The resistance shown on the Schedules are for tendering purposes only and the contractor shall be held responsible for checking the final system static pressure before ordering the equipment.

Fans shall be balanced and free from vibration. All fans shall have complete impeller assemblies including drive components, and statically and dynamically balanced to the following maximum allowable vibration criteria

Maximum allowable vibration peak to peak as follows,



	Centrifugal and Axial Fans	Displacements as measured on equipment: (mm)
1	Under 600 rpm	0.1
2	600 – 1000 rpm	0.075
3	1000 – 2000 rpm	0.05
4	Over 2000 rpm (Impeller speed)	0.025

Performance test of up to 100% normal running speed shall be conducted. The rotor and pulley shall be further balanced on site to the approval of the Engineer. Fans shall be performance tested to BS 848: Part 1:1980 and B.S. 848 Part 2:1985 and quality assured to BS 5750: Part 1.

Unless otherwise specified, fans shall be designed and constructed for continuous operation. All fans shall be fitted with engraved identification and directional labels giving full details of speed, power, pulley and belt sizes and type of grease required, and mechanically fixed where they can be easily seen and not subject to potential damage.

After manufacture, the casing, impeller shaft and belt guards shall be thoroughly cleaned and given two coats of “Anodise” anti-corrosive paint or other approved treatment.

CENTRIFUGAL FANS

Centrifugal fans shall be supplied and fitted generally as shown on the accompanying drawings. All centrifugal fans shall be belt driven unless otherwise noted on the Schedule. All vee- belt drives and shafts shall be fitted with easily removable expanded and flattened steel guard of 6mm mesh size and mounted on 14 SWG angle steel framework. All guards shall have access openings to the shaft ends to enable tachometer reading to be taken.

All belt drives shall have approved lock pulleys on both the driver and driven. Belts sets shall be matched. Belts which have taken a permanent set through remaining idle shall be rejected. Motor speed and fan speed shall not exceed 1500 rpm.

The main vibration isolators shall be metal springs, fitted with ribbed neoprene pads not less than 8mm thick at the top and bottom of the spring. The ratio of the spring height to spring width shall be approximately equal when the spring is deflected under load. Mounting shall be located high enough or spaced far enough apart to prevent the machine rocking excessively. Mounting shall be easily visible and accessible for inspection and maintenance. When the mountings are carrying the static load, there shall be a clearance of not less than 20mm under the base.

In the loaded condition, the spring shall be able to sustain a further 50% increase in load before the spring bottom, in this condition it shall not exceed the elastic limit of the spring. All springs shall be constructed of best quality steel, properly heat treated.

For ceiling mounted arrangement, the fan shall sit on anti-vibration mountings fixed on steel mounting frame supplied and installed by the Contractor. Threaded suspension rods



with lock nuts shall be used for level adjustment. Anti-vibration mounting shall be selected to cater for different point load of the fan at four corners.

All isolators shall be sized to have the following static deflection when loaded unless otherwise stated in the Schedules and/or Drawings: -

	Operating Speed	Deflection (mm)
1	1000 rpm and above	25
2	500 rpm – 1000 rpm	40
3	400 rpm – 500 rpm	50

IN-LINE-FANS

In-line duct fans shall have non-overloading characteristics to suit the performance duty specified. In-line duct fans shall be of direct driven type. The fan blades shall be aerodynamically designed, backward-curved, constructed of aluminum plate and combining the impeller with the rotor of the external-rotor motor. Motors and impeller shall be factory matched and statically and dynamically balanced. Motors shall be suitable for operating in atmosphere of up to 95% RH and up to 50°C.

The fan housing or casing shall be constructed in heavy gauge (1.4 mm minimum) mild steel with paint finish or powder coating and stored dried, and flanged at both ends for bolting direct to connection ductwork.

Ceiling Mounted Exhaust Fan

The fan shall consists of either plastic or aluminum or GI casing mounted on the ceiling and exhaust ventilation unit with a front grille panel. The casing shall have a gravity backdraft damper to prevent backdraft.

DUCTWORK AND AIR DIFFUSION EQUIPMENT

DUCTWORK

All ductwork fittings, accessories, joints, and jointing materials shall be suitable for the service and shall not deteriorate due to atmospheric action. All fire dampers and casings shall be manufactured and installed in accordance with the NFPA or BSEN and local Fire Authority requirements. The contractor shall be responsible for obtaining approval from the Local Fire Authority for the fire damper installation details and any fee incurred. All ductwork and materials including linings, adhesives, flexible ducts, flexible connections, gaskets, sealants, fiberglass boards, etc., shall fully comply with all requirements of the British Standards in respect of resistance to penetration of fire and spread of flame and smoke.

The materials, construction, and installation of all sheet metal ductwork and fittings shall be in accordance with the specification for sheet metal ductwork, DW/144:1998 (HVAC)



Where any part of the installation is not covered by the HVAC specifications, then the standard of the sheet Metal and air conditioning contractor's National Association of U.S.A. (SMACNA) latest edition shall apply for either high velocity or low velocity systems. Where any part of the installation shown on the drawings is not covered by either the HVAC or SMACNA standard, then reference shall be made to the Engineer for approval of materials and methods prior to installation.

GI DUCTWORK

The ducting shall be made using good quality GI sheeting. The thickness of GI sheeting to be used and the type of joints are as follows. The duct fabrication shall be in accordance with latest SMACNA Standards for either high velocity or low velocity systems.

The Material specifications for construction of the sheet metal ducting will be as follows.

Max. Side Dimension of Duct in mm	GI Sheet thickness In mm	Type of Transverse Joint Connection	Bracing
Up to 450	0.6	S, drive slip ,pocket slip, or bar slip	None
450 to 750	0.8	Hemmed S, pocket slip , or bar slip	25 x 25 x 3 mm Angles at 1200 mm centers
750 to 1200	1.0	Hemmed S, pocket slip , or bar slip	25 x 25 x 3 mm Angles at 1200 mm centers
Over 1200	1.2	50 x 50 x 4.5 mm. Angle with gasket.	50 x 50 x 4.5 mm Angle at 600 centers

The following variations from the above will be accepted.

- Ducts where the larger dimension does not exceed 750 mm, cross bracing will be accepted in place of the angle iron bracing.
- Proprietary duct connection different to the above will be considered if the manufacture's recommendations are strictly adhered to. The Client approval for such connection must be obtained in advance after submitting all the necessary technical data.
- A round duct fabricated out of GI sheet conforming to the above is accepted wherever possible in order to save limited spacing.

All ducts shall be adequately supported using steel hanger rods and supports. All horizontal runs of ducting shall be supported as follows. The hanger rods shall be of minimum diameter of 6 mm.

Cross sectional perimeter of Duct in mm	Maximum spacing between hangers
--	--



Less than 1500	2400mm
1600 to 2500	1800mm
Exceeding 2500	1200 mm

Fresh air supply, return air and treated outdoor fresh air supply ducts shall be insulated. Exhaust air, outdoor makeup air for kitchen hoods and outdoor fresh air ducts shall be insulated where ducts run through air conditioned spaces or false ceiling void of air conditioned spaces.

DUCT SUPPORTS, HANGERS AND BRACING

No vibration shall be transmitted from the ductwork of plant to the structure, and the Contractor shall provide resilient mounting to achieve this, where necessary.

The construction of hangers shall be in accordance with DW/144. All such hangers shall be provided with screw lengths or turnbuckles for adjustment of ducting runs to level. Welding of hanger to bearers shall not be permitted. All nuts shall be provided with washers and lock-nuts. Projecting ends of bolts shall be cut-off.

On no account shall supports be riveted or bolted to the air ducts. All vertical ductwork shall be supported by angle iron bearers under flange joints. The ducts shall be tightened to underside of slabs/beams and after the projecting ends of bolts are cut off, No other part of the support shall project below the bottom bearers, thus maintaining maximum height throughout. Lengths of steel angles and the like used in fabrication of the brackets, flanges, and bracing shall be cut from full length sections. Short lengths of sections butt welded together to form a longer length shall not be used. All hanger supports shall be laced as close as possible to transverse joints or bracings.

All ducts shall be carefully designed and provided with all necessary anchoring and flexible connections to prevent damage to either the ducts or the building structure due to expansion and/or contraction of the ducts or building.

All anchor points and flexible connections shall be shown on the shop drawings and specific approval shall be obtained from the Engineer before proceeding with the installation of any anchors or fixings to the building structure.

AIR DIFFUSERS

The grilles and diffusers shall be rated in accordance with ANSI/ASHRAE standard 70-2006. All grilles and diffusers shall have concealed fixing system and shall have quick release frame to facilitate cleaning or wall. All supply grilles and diffusers shall be mounted on substantial frame and shall be provided with soft rubber or felt joining ring inserted under the frame to prevent air leakage and the formation of condensate on the fitting. All grilles and diffusers shall not be less than the size indicated; where size is not given they shall be



capable of handling the air flows and distribution indicated without producing unacceptable air flow noise. The contractor shall select the supply air grilles and diffusers to achieve good air distribution and adequate air movement in the conditioned space.

In order for the ceiling grilles and diffusers to match with the false ceiling and ceiling layout pattern, the finishing and actual size of the grilles, diffusers shall be confirmed by the Architect before ordering. The exact location of the ceiling grilles and diffusers shall be coordinated with other services. The contractor shall confirm the exact location with the Architect before works commence.

The finishing colour of the grilles and diffusers shall be approved by the architect. . The contractor shall co-ordinate with the Building Contractor and other specialist contractors such as ceiling and electrical contractor for the integration of the air diffuser into the ceiling and luminaire.

Volume control dampers of opposite blade type shall be provided behind supply, return and exhaust air diffusers, registers and grilles to control the air flow rates where necessary. Opposite bladed dampers shall have blades linked together in sections for ganged operation from adjusting screws. Where opposite bladed dampers are mounted on the back of outlets or grilles, the Screws shall be accessible through the blades of the outlet. Where the opposite bladed dampers are mounted in the duct spigots back from the outlets, then the screws adjustment shall be accessible by Removing the registers or grilles. Outlets shall be fixed using concealed screws. Exposed fixing shall be rejected.

The grilles and diffusers shall be Powder coated Aluminum or plastic or as otherwise indicated. Plastic gills shall be used where condensation can be happened or suitable coating shall be applied on the grill surface if Aluminum is used.

DOUBLE DEFLECTION GRILLES

Each supply air grille shall have 2 sets of separately adjustable louvres, 1 set horizontal and 1 set vertical. The louvre and the damper (If available) shall be adjustable from the front of the grille.

SINGLE DEFLECTION GRILLES

Each supply air grill shall have a set of separately adjustable either horizontal or vertical louvres. The louvre and the damper (If available) shall be adjustable from the front of the grille.

EXTERNAL LOUVERS

All external louvres for air intake and air exhaust shall be supplied and fixed by the contractor.

All louvers shall be of the weatherproof type, formed from extruded aluminum or



PVC sections contoured to prevent the ingress of water. The colour of the louver shall be approved by the Architect. The total free area of any louver shall not be less than 70% of the face area indicated on the drawings and the pressure drop through any louver shall not exceed 25 Pa unless otherwise specified. All external louvers shall be corrosion resistant and suitable for climatic conditions.

Unless otherwise shown in the drawings, the contractor shall provide and fix anti insect screens behind all louvers. Washable rigid air filter shall be provided for the fresh air intake grilles. The screens shall be of suitable mesh and fixed in such manner as to facilitate easy removal for periodic cleaning.

DAMPERS

The Contractor shall supply and install volume control dampers at ducts or air grills as specified in the drawings. Dampers shall be accordance with SMACNA recommendation. All dampers shall be capable of performing their service without causing vibration or noise and dampers shall be provided with fully adjustable locking quadrants with the "open", "normal", and "closed" positions clearly marked.

VOLUME CONTROL DAMPERS

Volume control dampers shall be of the opposed blade multi-leaf type except for ducts less than 300 mm in height where single-leaf dampers may be used.

Damper blades shall be constructed of not less than 16 gauge galvanized sheet in two halves streamlined around spindles. Spindles shall be not less than 9.5 mm bright steel bar and shall rotate in bronze or nylon bushes at both ends. Spindles shall have a slot at each end to indicate damper position. All dampers shall be constructed to ensure air-tight closure of the blades when in the closed position.

NON RETURN DAMPERS

All non-return dampers shall be of light gauge galvanized steel sheet of sturdy construction with spindles running fully in oil impregnated bronze or other approved type of bearings. Damper blades shall be tipped with soft seat to ensure silent operation.

AIR FILTERS

The air filters scope of work covers the air filters for all fan coil units and outdoor air intake louvres.

Air filtration system comprising of a primary filter shall be provided for fan coil units. The filter media consists of high density, micro fine, glass fiber shall be of non-combustible throughout or with exposed surfaces of Class O flame spread rating and shall not generate



toxic gas when subject to heat or fire.

Each filter section shall be capable of handling the specified air quantity with face velocity not exceeding 2.5m/s and its performance characteristics shall meet the requirements of ASHRAE 52-76, Method of Testing Cleaning Devices.

Filters shall be installed in accordance with manufacturer's recommendations complete with all accessories necessary for their proper performance. Air filter connections to adjoining equipment, paneling or support framing shall be sealed airtight to ensure that no air bypasses the filter media. The filter assembly shall be easily accessible for inspection, maintenance and removal.

To improve indoor air quality and protect air conditioning equipment, outdoor air and re-circulated indoor air shall be filtered to remove dust, bacteria, pollens, insects, soot and dirt particles before it enters the air conditioning system. The following air cleaning devices, dependent on their compatibility with the general air conditioning system, shall be incorporated into the system as in-duct devices or stand-alone devices.

AIR FILTERS FOR FAN COIL UNIT

The filter shall be cleanable type mounted in lightweight metal frame with media held in position with PVC coated heavy gauge galvanized iron wire mesh. All-joint shall be fitted air tight with felt stripes. The complete unit including filter box shall be suitably treated against corrosion. The face velocity of air passing through the filter shall not exceed 1.8m/s

Air Filters for Outdoor Fresh Air

The filter shall be washable rigid type mounted in Aluminum frame. Filter media shall have min. efficiency of G3 under EN779-2002 or MERV5 under ASHRAE standard 52.2-2007

THERMAL INSULATIONS

All insulation work shall be carried out by skilled and experience craftsmen. Unless otherwise indicated, all thermal insulating materials used within any building shall comply with NFPA, BS 476-6: 2009, BS 476-7:1997, BS 476-12:1991 and the local fire authority. Insulation materials and their finishes shall be free from asbestos.

REFRIGERANT PIPEWORK INSULATION

Insulation used for condensate pipework shall be flexible closed cell elastomeric 25mm thick Insulation and shall be CFC free, in continuous lengths, with factory applied talc coating or on-site applied talc coating on inner surface. Flexible closed cell elastomeric insulation shall comply with the following requirements:-

- Thermal Conductivity (at 20°C mean temperature): <0.036 W/mK
- Density: 65 kg/m3 (+/-) 5%
- Maximum Operating Temperature: > 80°C



- The material, including adhesives and all accessories shall have fire properties to Class 'O'

All surfaces over which the insulation is to be applied shall be dry and grease free.

CONDENSATE PIPEWORK INSULATION

Insulation used for condensate pipework shall be flexible closed cell elastomeric 19mm thick Insulation and shall be CFC free, in continuous lengths, with factory applied talc coating or on-site applied talc coating on inner surface. Flexible closed cell elastomeric insulation shall comply with the following requirements:-

- Thermal Conductivity (at 20°C mean temperature): $<0.036 \text{ W/mK}$
- Density: 65 kg/m^3 (+/-) 5%
- Maximum Operating Temperature: $> 80^\circ\text{C}$
- The material, including adhesives and all accessories shall have fire properties to Class 'O'

The insulation shall be resistant to water vapor transmission and painted with minimum two coats of manufacturer's recommended paint in outdoor application. The paint shall be a highly flexible polymeric coating which provides outdoor weather protection and resistance to ultraviolet radiation and chemical attack on elastomeric insulation.

All surfaces over which the insulation is to be applied shall be dry and grease free. Insulation shall be applied so as to give a smooth, homogeneous and line able surface. All rigid sections shall be concentric, and accurately matched for thickness. Steps and undulations in the surfaces shall not be acceptable. Any sections or slabs having damaged ends or edges shall be rejected.

DUCTWORK INSULATION

Insulation used for ductwork shall be semi rigid having a density of not less than 48 kg/m^3 and thickness not less than 50 mm. The diameter of the glass fiber shall be of 4 to 10 micron and fiber length shall be of 3 to 6 cm.

The thermal conductivity (k value) of the glass fiber shall not be more than 0.036 W/mK at a mean temperature of 20°C .

Ductwork shall be insulated from hangers and supports generally as indicated in DW/144:1988 (HVCA). All joints shall be sealed with at least 75mm wide vapor barrier tape to provide a continuous external vapor seal. Prior to the application of tape all contact surfaces of vapor barrier foil shall be wiped clean of dust and grease using cloth and suitable solvent all in accordance with the manufacturer's recommendation. All duct work insulation shall extend over external flanges and stiffening.

Insulation shall be applied to form a continuous heat barrier without gaps, cavities and



openings, Care shall be exercised to ensure that the minimum thickness specified is maintained at corners, protrusions, etc. At the point of support, specially prepared blocks of hardwood or Styrofoam material must be positioned to ensure integrity of vapor barrier by bonding the supports to the insulation.

All insulation shall be applied to give a smooth, homogeneous and line able surface. All rigid sections shall be concentric, and accurately matched for thickness. Steps and undulations in the surfaces shall not be acceptable. Any sections or slabs having damaged ends or edges shall be rejected. All insulation shall fit tight to surfaces to be covered, and all slabs and sections shall be built up close, butting edges being metered, chamfered, or shaped as necessary. Any minor interstices left in insulation shall be filled and sealed. Insulation shall be applied to clean and dry surfaces, free of foreign materials such as oil, grease, rust, scale, or dirt.

All surface to be insulated, which shows any signs of rusting or damage to galvanizing shall, prior to insulating, be thoroughly scraped and wire brushed as necessary to remove all rust, scale, etc. Surfaces shall then be solvent cleaned to remove all oil, grease, and dirt prior to the application of a coat of primer. Only clean and dry insulation shall be used. Insulation shall generally be applied in accordance with the manufacturer's recommendations. Continuous insulation shall be provided through all sleeves and insulation joins shall be staggered with respect to joints on the associated ductwork system.

Where ducts pass through fire walls and slabs, suitable fire stop system shall be provided for the duct including the fire damper. The continuity of the insulation shall be maintained throughout.

LABELLING

All plant and equipment provided under this specification shall be labeled in English, all such labeling to correspond to schedules, diagrams, etc. to be provided as part of the record drawings. Labels are of white Trifoliate with black engraved lettering not less than 20mm high or as otherwise required and approved.

Manufacturers' nameplate shall generally be provided for all plant and equipment and shall show serial and model numbers and date of manufacture. The following refers to specific items (but not be limited to) requiring labeling:

- All motor starters, fans, distribution boards, gauges, contactors, cable terminals in switchboards, circuit breakers.
- Distribution boards, starters etc. are to be labeled to indicate the circuit number, phase and item controlled.

PRESSURE TESTING, EVACUATION AND COMMISSIONING

After Installation of pipe work, and prior to sealing of insulation joints, pipe work should be pressure tested to 38 bar, held for 24 hours and checked for leaks, vacuumed/dehydrated to -752 mm Hg and held at that setting for 1 to 4 hours depending



on the pipe length. Supplier submits detailed information for installation and commissioning procedures for approval after completion of installation.

WIRING

3 PHASE UNITS

A fused 415 V - 3 Phase, N + E power supply with external isolator shall be made available for each outdoor unit. The fuse rating for the 5 hp outdoor unit shall be 20 Amps, the 8 and 10 hp outdoor units shall be 32 amps and the 12, 14 and 16 hp units shall be 40 Amp. All fuses / circuit breakers (MCCB not MCB) should be motor rated.

SINGLE PHASE UNIT

A fused 220 V - 1 Phase, N + E power supply with external isolator shall be made available for each outdoor unit. The fuse rating for the 4 and 5 hp outdoor unit shall be 20 Amps, the 6 hp outdoor units shall be 25 amps. All fuses / circuit breakers should be motor rated. A fused 240 V - 1 Phase, N + E Power supply shall be made available for each indoor unit, the HR box and the centralized control system. Maximum 15 amps ring main for the indoor units and HR boxes and a 5 Amp fused spur shall be provided locally to each item.

Control cable to the following specification shall be used:

- 1 core PVC shielded cable sized between 0.75 mm² and 1.25 mm².

Control and power cables must not be installed alongside each other as interference in the signal wiring caused by electrostatic and electromagnetic coupling can occur.

The table below indicates recommendation as to the appropriate spacing of control and power cables where these run side by side:

Current capacity of the power cables		Spacing
100 v or more	10 amp or less	300 mm
	10 - 50 amps	500 mm
	50 -100 amps	1000 mm
	100 amp +	1500 mm

The control cables shall be installed on conduits. Care must be taken to ensure that they are not tied together or packed tightly.

ELECTRIC WIRING

- 1.0 The Contractor will be responsible for complete electric wiring and earthing of the plant, equipment and controls. The Employer shall only provide 3 phase and neutral, 4 wire electric supply point(s) with two earthing points, and 1 phase, neutral and earth, 3 wire electric supply point(s) at locations shown in the drawings and detailed elsewhere in the documents.



- 2.0 The electrical work shall be carried out by licensed workmen authorized to undertake such works under the provisions of the Electricity rules.
- 4.0 The climatic conditions shall be temperatures between 2°C (min) and 45°C (max) with max. relative humidity 90%, unless lower min. and higher max. temperatures are specified elsewhere in the documents.
- 5.0 The electric wiring shall be carried out in MS or G.I. conduits as specified, 18g G.I. sheet metal trunking or cable trays, or G.I. (medium weight) piping as specified and/or shown in drawings. All wiring buried in floor or exposed to weather to be in G.I. piping (mw). MS conduit to be of 16g, given anti rust coating and then painted with black enamel paint. Conduits buried in slabs or walls may be PVC conduits or PVC Class D pipes as specified in the drawings. Sheet metal trunking or cable trays installed indoor shall have ventilation slots; those installed in Building shafts shall have removable covers and installed outside shall be of weather proof construction with removable covers. The wire sizes shall be selected for satisfactory operation at least 45°C ambient temperature derated according to installation method and grouping as envisaged.
- 6.0 The terminal connections for motors and where required for starters, shall be made in flexible conduit. The terminal wiring for 230 volt, 1 phase below 0.5 HP motors (such as for fan-coil units, small ventilation-exhaust fans) and their starter control switches can be exposed PVC insulated and sheathed wiring, connections protected within the terminal box so that no live lead is exposed.
- 7.0 The wiring for electric/electronic automatic controls shall preferably be with single conductor wire which may be PVC insulated within metal conduits, exposed shielded or exposed PVC insulated and sheathed wiring in accordance with the recommendations of the control manufacturer. The live connections shall be protected by the cover plates to avoid any hazard. The wiring outside the plant rooms or fan-coil unit enclosures must be in conduit to avoid any mechanical damage.
- 8.0 All Motor Control Centres(MCCs) or Control Boards shall be Factory fabricated of an approved listed manufacturer.
- 9.0 On each Motor Control Centre (MCC), the incoming supply shall have a circuit breaker for 20 amps and above rating and circuit breaker or disconnect switch with fuses for lower rating. The circuit breaker shall be of high rupture capacity, heavy continuous duty, moulded case type (MCCB) for 1000amps and below rating and air-breaker (ACB) type for rating above 1000 amps. The circuit breaker shall have adjustable magnetic short circuit trip and adjustable thermal overload trip. In MCCs with multi circuit outgoings, the incoming MCCB of 100amp and above or ACB shall have high and low voltage release, rated 415 volt +20% adjustable range. The MCCB or ACB to



be manually reset after trip. The minimum rupture capacities (IEC 157-1 P-1 rating or IEC 947-2 Icu rating) at 415 volt of MCCBs shall be as follows:

RATING	RUPTURE CAPACITY
Up to 30 amp rating	10 KA
40 to 225 amp rating	25 KA
250 to 400 amp rating	30 KA
500 to 600 amp rating	35 KA
800 amp rating	50 KA
1000 amp rating	65 KA

Miniature Circuit Breakers (MCB) shall have minimum rupture capacity of 5KA and to have off-on-reset switch with handle. The 3-phase MCB shall make or break all 3 circuits simultaneously. MCB may be used for single phase circuits up to 30amp rating. 3-phase MCB may be used for motors 4HP and below or for general power supply circuit 30amp and below.

The disconnect switch shall be rotary type. The fuses shall be HRC time lag link type according to BS 88:1952 and ASTA-20 certified. Two sets of replacement HRC fuses shall be supplied as spare for each disconnect switch.

Each outgoing individual circuit shall have a ACB or MCCB or MCB or disconnect switch with fuses according to rating limits specified above. The outgoing for each motor circuit shall be provided with:

1-phase MCB	for single phase motors up to 1HP
3-phase MCB	for 3-phase motors 4HP and below.
MCCB	for 3-phase motors above 4HP.

- 3.0 Single phasing preventer relay shall be provided for each 3 phase circuit of 1 HP and above rating as part of motor starter.
- 1.0 The Contractor shall supply and install necessary Motor Control Centres (MCCs), Control Boards, circuit breakers, disconnect switches, fuses, MCBs, earthing, etc. to complete the work. It is required, where possible, to mount all circuit breakers, disconnect switches, fuses, starters, contactors and relays, etc. in one machine room on one MCC for ease of operation.
- 13.0 The Contractor shall submit schematic electric wiring diagrams, manufacturer's construction drawings, component selection lists with manufacturers' technical literature for all components proposed to be used to the Consultant for checking and approval before the fabrication of MCCs and Control Boards is commenced. The work will be carried out only in accordance with the approved drawings and components.
- 14.0 All components and wires shall be selected/sized with required derating for site ambient and altitude as specified and close grouping within the



enclosed space of a MCC or Control Board.

- 15.0 Each Motor Control Centre shall have three phase indicating lights, incoming supply voltmeter with phase selector switch, three ammeters one for each phase if more than one outgoing and total load 30 KW (40 HP) and above, an incoming ACB or MCCB according to load, a MCCB or MCB for each outgoing according to circuit rating, motor starters, ammeters, indicator lights, etc.

All starters/contactors for motors and equipment operation control shall have rotary type hand/off/auto switch. With HOA switch in "auto" position the motor/equipment shall be remote operated from the MCC so designated or Building DDC System as specified, "hand" position would permit local operation and testing, while the "off" position would ensure that all circuits are deenergized for servicing and checking.

- 16.0 Each out going shall circuit shall have a MCCB according to circuit rating and indicating lights. Each out going for motors shall have rotary type hand/off/auto switches, star- delta motor starters, contactors, ammeters, etc.

- 17.0 Contractor shall provide three sets of fuses, indicating lamps, one manometer and one voltmeter as spares.

SPARE PARTS

The tenderer shall include the price of complete set of spare parts for all items supplied by him required for two years operation for the specified operating hours as recommended by manufacturer and specified elsewhere. In particular, spares shall be provided for electrical equipment, fuses, controls, instruments, bearings, flexible couplings, belts, gaskets, O-rings, etc. without which the equipment would become non-operative.

The following spares shall be supplied for the V.R.V system (For each Typical model)

- i. 01 Nos Spare Compressor for (Each Compressor Model)
- ii. 02 Nos Spare Condenser Motors & Fan for (Each Fan Model)
- iii. 02 Nos Spare Fan Motors for Each indoor Model. (1TR,2TR,3TR and 4TR)
- iv. 02 Nos Spare Drain Pump for Each indoor Model. (1TR,2TR,3TR and 4TR)
- v. 03 Nos Spare PCB Cards for each indoor (1TR,2TR,3TR and 4TR)
- vi. 03 Nos Spare Main PCB Cards for each type of outdoors
- vii. 03 No's spare cards for outdoor fan PCB
- viii. 02 No's spare PCB cards each used in outdoors other than main and fan PCB
- ix. 02 No's of each expansion valve
- x. 02 No's Sensors Set for Outdoor units
- xi. 02 No's Sensors Set for Indoor Units
- xii. 05 No's Refrigerant 410 A (11.3 Kg) Cylinders



SPECIAL TOOLS AND INSTRUMENTS FOR MAINTENANCE

- 1.0 The Contractor shall supply to the Employer all necessary special tools and instruments required for proper operation, servicing and maintenance of the complete plant.
- 2.0 The tenderer shall give a complete List of special tools and instruments included in his tender.
- 3.0 Amongst others, following shall be included without limitation:
 - 3.1 Tong Tester of suitable range with Amp, Volt and ohm scales.
 - 3.2 One set each of open end, ring and adjustable spanners.
 - 3.3 One set each of flat and Philips head screw drivers.
 - 3.4 Set of hammers.
 - 3.5 Two pliers with flat and pointed nose.
 - 3.6 Set of Adjustable wrenches (Make: Force)
 - 3.7 Offset Box Wrenches (all Standard Sizes) (Make: Force)
 - 3.8 Electric Air Blower, Industrial Type (Make: Hyundai)
 - 3.9 Bench vice (6" Size) = 01 No.
 - 3.10 Karcher Machine (Make: Karcher)
 - 3.11 Service Bags= 05 No
 - 3.12 Plastic Bag waterproof for washing of Cassette units = 01 No

MAINTENANCE

01. The Contractor shall be responsible without additional charge to the Employer for maintenance and servicing of the complete plant during the period of maintenance named in the Memorandum after the issue of the Certificate of Substantial Completion by the Engineer.
02. The Contractor shall be responsible for arranging all tools, instruments and Technical Staff including Specialist Technicians/Engineers required for the work. The Employer shall be responsible to supply all materials and spare parts required for the work excluding parts defective due to manufacturing defect which shall be replaced by the Contractor under the terms of the contract.
03. The Contractor shall service the complete plant regularly according to the Schedule of Servicing and Maintenance as approved or amended by the Client but not less than once a month during the operational seasons. The service and maintenance shall be carried out by competent skilled labor under supervision of a qualified Engineer.



04. The Contractor shall take a certificate of satisfactory completion of monthly servicing from the Employer's Representative.
05. The Contractor shall carry out annual servicing, maintenance and overhauling of the complete plant at the end of the operational season and make the plant ready for operation in all respects well before the commencement of the next operational season. On receiving notification from the Contractor that annual servicing, etc. is nearing completion, the Consultant shall check the work carried out and give directions to the Contractor for completion of outstanding work, if any.
06. On satisfactory completion of annual servicing, maintenance and overhauling of the complete plant, the Engineer shall issue a Certificate of satisfactory completion to the Contractor.



TECHNICAL DATA OF VRV UNITS

All bidders are required to accurately fill in the table with comprehensive details for each outdoor unit and indoor unit. This data will be meticulously verified against the equipment catalog to ensure authenticity and compliance with technical requirements outlined in the tender document.

OUTDOOR UNITS

Unit Tag			OU-01	OU-02
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-03	OU-04
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-05	OU-06
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-07	OU-08
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-09	OU-10
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-11	OU-12
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Unit Tag			OU-13	OU-14
Make				
Origin				
Model Number (Nominal)				
Base Models (Nominal)				
Connected Load		TR		
Actual Cooling Capacity @ 46 deg		TR		
Capacity	Cooling (Nominal)	kW		
		TR		
	Heating (Nominal)	kW		
		TR		
Power Supply		V~		
Power Input	Cooling	kW		
	Heating	kW		
Rated Current	Cooling	Amp		
	Heating	Amp		
EER				
Sound Pressure Level	Unit	dB(A)		
Compressor	Type	-		
	Quantity (each Model)	No		
Refrigerant Type				
Indoor	Dimension			
	Fresh Air Provision			
Outdoor	Dimension	mm		
	Net Weight	kg		
Max Pipe Length	Max Distance Length	m		
	1st IDU to farthest IDU	m		
Ambient Design	Summer Dry Bulb	°C		
	Summer Wet Bulb	°C		
	Winter Dry Bulb	°C		
Indoor Condition	Temperature	°C		
	RH	%		



Outdoor Unit	Model	Required Capacity (Ton)	Rated Capacity (Ton)	Rated Power Input (kW)	Corrected Capacity @ 45 deg C (Ton)	Corrected Power Input @ 45 deg C	Corrected Capacity @ 50 deg C (Ton)	Corrected Power Input @ 50 deg C
VRF-01		31						
VRF-02		31						
VRF-03		31						
VRF-04		31						
VRF-05		31						
VRF-06		32						
VRF-07		32						
VRF-08		30						
VRF-09		31						
VRF-10		32						
VRF-11		27						
VRF-12		30						
VRF-13		19						
VRF-14		20						
TOTAL		408						



INDOOR UNITS

Unit Type (Indoor)			IU-01	IU-02	OU-03
Make					
Origin					
Model Number					
Required Capacity		TR			
Actual Cooling Capacity @ Site		TR			
Capacity	Cooling (Nominal)	kW			
		TR			
Power Supply		V~			
Power Input	Cooling	kW			
Rated Current	Cooling	Amp			
EER					
Sound Level	Unit	dB(A)			
Filter Type					
Indoor	Fresh Air Provision				
	Dimension (WxHxD)	mm			
	Net Weight	kg			

Unit Type (Indoor)			IU-04	IU-05	OU-06
Make					
Origin					
Model Number					
Required Capacity		TR			
Actual Cooling Capacity @ Site		TR			
Capacity	Cooling (Nominal)	kW			
		TR			
Power Supply		V~			
Power Input	Cooling	kW			
Rated Current	Cooling	Amp			
EER					
Sound Level	Unit	dB(A)			
Filter Type					
Indoor	Fresh Air Provision				
	Dimension (WxHxD)	mm			
	Net Weight	kg			



General Technical Compliance of VRV Units

S.No	Details	Filled by Manufacturer
1	Country of origin certificate is required.	
2	Provide the manufacturer's original catalogue of all units.	
3	Refrigerant pipe sizes are required as per actual length from indoor to outdoor units.	
4	Design criteria The air-conditioning system has been designed in accordance with the following criteria. Ambient Temperature as mentioned in schedule Inside design Temp.	
5	Computer software selection sheet required at fan medium speed & outdoor units' ambient temperature.	
6	The coil shall be tested against leak test by nitrogen pressure of 450 psig under water. The test certificate confirming the same shall be furnished.	
7	The condenser fins (Aluminium) shall be hydrophilic coating for Seline and corrosive environment.	
8	Casing shall be heavy gauge zinc coated galvanized steel sheets confirming to JIS-G 3302 and ASTM A-635. Extremely scratch resistance. Excellent anti corrosive protection. 5% salt spray test at 40 °C & 95% RH & tested certificates shall be submitted along with units.	
9	Body of all condensing units should be powder coated.	
10	All welded joints of copper in condensing units should be covered with anti-corrosion paint.	
11	Compliance sheet (Comparative Statement) with design data schedule is required of all units.	
12	Fan grills of all condensing units should be made of UV resistant plastic.	
13	Compressor Compressor shall be equipped with inverter controller which shall be capable of altering the speed to meet variations in cooling load. Outdoor unit proposed shall be suitable to work with different type of indoor units in the same circuit.	
A		
B	Compressor shall be high performance and high efficiency scroll type. The compressor shall be driven by an electric motor in a single housing for stability and additional sound attenuation, the scroll shall be mounted in double wall housing.	
C	The compressor motor shall be refrigerant gas cooled. Each compressor shall be mounted on ant vibration mounts to minimize vibration transmission.	
D	Compressor shall have discharge shut off valves, built in microprocessor-controlled oil separator, long lifeline oil filer, insertion type oil heater with sleeve, oil sight glass, oil fill and suction gas filer.	
E	Supplier should mention the compressor models of each VRF outdoor unit model.	



14	The refrigerant used shall be environment friendly CFC freeR-410.	
15	VRF Units should supply with pre-factory refrigerant gas charged.	
16	Additional refrigerant gas (quantity given by selection software) provided by supplier at site.	
17	The refrigerant piping shall be capable of working with extended lengths up to 60m with 50m level difference without any oil traps.	
18	Unit shall be equipped with oil recovery system to ensure stable operation with this long refrigerant piping.	
19	Each machine shall consist of at least one refrigerating circuit consisting of compressor. Air cooled condenser, interconnecting piping, controls, safety devices and accessories.	
20	The machine shall be factory assembled, leak tested evacuated and completely charged with environment friendly refrigerant. All factory wiring and piping shall be contained within the machine enclosure. All the electrical components shall be protected from corrosive weather.	
21	The unit shall be rated according to ARI/JQA standards. Each machine shall be capable of operating satisfactory in a wide range to ambient air temperature ranging from -7 °C to 52 °C.	
22	Unless indicated otherwise on electrical wiring diagram, each unit shall be factory equipped to connect to only one electrical power feeder with the necessary built in circuit breaker.	
23	The noise level shall not be more the 58 dBA at normal operation measured 3 meters away from the unit.	
24	Each unit should be mounted on anti vibration isolators to dampen vibration to 99%.	
25	The supplier shall supply, and commission factory assemble air cooled package VRF units.	
26	Supplier's representative / engineer will visit the site during VRF pipe installation and pressure testing & submit the detail report / observation according to the manufacturer recommendation.	
27	Testing and commissioning of the VRF Units / System should be done by the supplier's representative / engineer.	
28	Warranty duration should be 2 years comprehensive, inclusive parts and services.	
29	How will manufacturer / supplier manage warranty services?	
30	How manufacturer / supplier support for quality control of installation works?	

Confirmation By Local Authorized Agent

Confirmation By Principal
Manufacturer

Date

Date



SCHEDULE OF EQUIPMENT

VRV SCHEDULE									
S.NO	FLOOR	VRV NO.	INDOOR TYPE	TR	QTY	CAPACITY (CONNECTED LOAD)	REMARKS		
1	BASEMENT	1	Cassette	1	3	31			
				3	2				
				4	4				
			F.A UNIT	6	1				
2	BASEMENT	2	Cassette	3	7	31			
				4	1				
			F.A UNIT	6	1				
3	BASEMENT	3	Cassette	3	1	31			
				4	6				
			F.A UNIT	4	1				
4	BASEMENT	4	Cassette	2	1	31			
				3	2				
				4	1				
	GROUND		Cassette	4	1				
				1	5				
				2	1				
				4	2				
5	GROUND	5	Cassette	1	5	31			
				2	1				
				3	2				
				4	3				
			F.A UNIT	6	1				
6	GROUND	6	Cassette	3	2	32			
				4	4				
	1ST FLOOR		Cassette	6	1				
				4	1				
7	GROUND	7	Cassette	2	4	32			
	1ST FLOOR			2	4				
			F.A UNIT	4	1				
			2ND FLOOR	Cassette	2				
	F.A UNIT			4	1				
8	GROUND	8	Cassette	4	3	30			
	1ST FLOOR			1.5	4				
				3	4				



9	1ST FLOOR	9	Cassette	3	3	31	
				4	4		
			F.A UNIT	6	1		
10	1ST FLOOR	10	Cassette	4	2	32	
	2ND FLOOR			4	5		
			F.A UNIT	4	1		
11	2ND FLOOR	11	Cassette	4	1	27	
	3RD FLOOR			3	1		
				4	5		
12	2ND FLOOR	12	Cassette	4	6	30	
			F.A UNIT	6	1		
13	2ND FLOOR	13	Cassette	2	2	19	
	3RD FLOOR			2	3		
				3	3		
14	1ST FLOOR	14	Cassette	1.5	2	20	
				3	3		
				4	1		
			F.A UNIT	4	1		
1	INDOOR CONDITION- 23 DEGREE C (50%R.H)						
2	OUTDOOR DESIGN CONDITION- 45 DEGREE.C (UNIT OPERATIONAL RANGE-T3. -7TO+52DEGREE C)						
3	THE VRV UNITS SHOULD BE HIGH EFFICIENCY AND THE MINIMUM EER (W/W) OF EACH OUTDOOR CIRCUIT SHOULD BE 4.0 OR MORE						



SECTION - 06

SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
I	Supply, Installation, Testing & Commissioning of Air-cooled electric operated, Full D.C inverter, Reversible Type condensing outdoor units, high EER efficiency (T-3 Ranges -7 to +52 degree C) inverter base compressor with special anti rust coating on condenser Fins. vibration isolators, factory wired weather proof cabi-net type control center, atmosphere friendly refrigerant etc. Complete with safety controls and accessories as per specification and drawings (Note: each unit shall have maximum three separate refrigerant circuits with isolation valve. Selection ambient temp. 45 degree C.	Nos.					
i.	Outdoor Units 01 (Connected load-31 TR)	1					
ii.	Outdoor Units 02 (Connected load-31 TR)	1					
iii.	Outdoor Units 03 (Connected load-31 TR)	1					
iv.	Outdoor Units 04 (Connected load-31 TR)	1					
v.	Outdoor Units 05 (Connected load-31 TR)	1					
vi.	Outdoor Units 06 (Connected load-32 TR)	1					
vii.	Outdoor Units 07 (Connected load-32 TR)	1					
viii.	Outdoor Units 08 (Connected load-30 TR)	1					
ix.	Outdoor Units 09 (Connected load-31 TR)	1					
x.	Outdoor Units 10 (Connected load-32 TR)	1					
xi.	Outdoor Units 11 (Connected load-27 TR)	1					



SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALtATION	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
xii.	Outdoor Units 12 (Connected load-30 TR)	1					
xiii.	Outdoor Units 13 (Connected load-19 TR)	1					
xiv.	Outdoor Units 14 (Connected load-20 TR)	1					
2	Supply, Installation, Testing & Commissioning of Indoor Units Complete with safety controls, thermostat wired and remote both type controller and accessories as per specification and drawings.						
2a	8-Way / 360 degree discharge Cassette Type (with Wired Remote Controllers)	Nos.					
i.	1.0 TR	13					
ii.	1.5 TR	8					
iii.	2.0 TR	20					
iv.	3.0 TR	29					
v.	4.0 TR	49					
2b	Supply, Installation, Testing & Commissioning of Ducted D.C Inverter type Fresh air Indoor Unit, quiet sound operated Indoor units complete with DC fan motor, automatic and safety controls. Insulated drain, thermostat wired and remote both and accessories as per drawing and specification.	Nos.					
i.	4.0TR (14 kW)	6					
ii.	6.0 TR (22.4 kW)	6					



SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
3	Supply, Installation, Testing & Commissioning of Centralized BMS system for HVAC system, including Integrated Centralized Remote Controller with Software for Remote Operation, Complete wiring, energy meter/energy management for all indoor/outdoors, other equipment and other parameters as per specification and drawings.	1 Job					
4	Supply, Installation Testing & Commissioning of Imported fitting and components Y-Branches complete with all respects.	1 Job					
5	Supply, Installation, Testing & Commissioning of Complete Copper Piping (ASTM-B-280 for Air Conditioning and Refrigeration) (liquid + Gas) with isolation valve, 3/4" thick closed cell foam insulation for indoor piping, 1" thick closed cell foam insulation for outdoor piping, cladding, core cutting, chiseling, cutting, hanger support, wooden saddle complete with all respects as specification. (Bidder can change the below mentioned Quantities as per your selection report of VRV Equipment)						
5A	Copper Piping and insulation.	Rft.					
i.	1/4"	150					
ii.	3/8"	2300					
iii.	1/2"	700					
iv.	5/8"	2000					
v.	3/4"	2500					
vi.	7/8"	300					
vii.	1"	300					
viii.	1-1/8"	700					



SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTAtLAtIQN	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
ix.	1-1/4"	300					
x.	1-3/8"	250					
xi.	1-1/2"	250					
xii.	1-5/8"	1200					
5B	Supply & Installation of Powder Coated 18 Gauge Cable tray with cover, hangers for External/shaft Piping & electrical wiring complete with all respects.	Rft.					
i.	30"X3"	70					
ii.	24"X3'	140					
iii.	12"X3	150					
iv.	8"X3"	20					
5C	Isolation Valve	Nos.					
i.	1.0 TR	26					
ii.	1.5 TR	24					
iii.	2.0 TR	40					
iv.	3.0 TR	56					
v.	4.0 TR	110					
vi.	6.0 TR	12					



SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTAtLAtIQN	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
6	Supply, Installation, Testing & Commissioning of UPVC Class D Piping for equipment drain complete with Specialties, 3/4" thick closed cell foam Insulation, cladding, fitting, core cutting & hanger supports, wooden saddle, anitfungus & fire retardant paint etc. as per specification and drawings,	Rft.					
i.	2" dia	1000					
ii.	1 1/2" dia	600					
iii.	1 1/4" dia	1000					
iv.	1" dia	450					
v.	3/4" dia	100					
7	Supply, Installation, Testing & Commissioning of Weatherproof MCC for hvac System with circuit Breakers, Disconnect switches, fuses, starters, automatic phase sequence, phase reversal etc. for all equipment as per specification & drawing. (Isolation breakers shall be finalized as per manufacturer spccifications).	No.					
i.	MCC No-1	1					
ii.	MCC No-2	1					
iii.	MCC No- 3 (With AHUs connection provision for Future)	1					
8	Supply & Insrallation of Complete Electric power (from electric point to indoor units and from MCC to Units as shown in drawing) & control wiring complete with hanger supports, isolation breakers etc. for Equipment as per Specification and drawings.	RFT.					
a	1 x 4C x 120 Sqmm CU/PVC Cable with earth Cable.	200					
b	1 x 4C x 25 Sqmm CU/PVC Cable with earth Cable.	650					
c	1 x 4C x 16 Sqmm CU/PVC Cable with earth Cable.	10					



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BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALATION	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
d	1 x 4C x 10 Sqmm CU/PVC Cable with earth Cable.	10					
e	1 x 4C x 6 Sqmm CU/PVC Cable with earth Cable.	10					
f	1 x 4C x 5 Sqmm CU/PVC Cable with earth Cable.	100					
g	1 x 4C x 2.5 Sqmm CU/PVC Cable with earth Cable.	100					
h	Control & Communication Wiring with conduit.	5500					
i	Electric supply point	140					
9	Supply, Installation, Testing & Commissioning of Ventilation & Exhaust fan with fitting & supports etc. as per specification and drawings.	Nos.					
i.	Centrifugal Cabinet Type Toilet Exhaust Fan No.1 (3500 cfm @1.8" E.S.P) (Rate Only)	0					
ii.	Decorative type propeller fans complete with all respects. (400CFM)	4					
iii.	Inline fans complete with all respects, (400 cfm @0.8" E.S.P)	1					
iv.	Inline fans complete with all respects, (800 cfm @0.8" E.S.P)	7					
10	Supply, Installation, Testing & Commissioning of Low pressure G.I. Sheet Metal ducting (Machine Made) as per SMACNA & ASHRAE Standards for air ducting, plenums and other sheet fabrications including splitter dampers, take off, wire mesh on duct opening, core cutting. vanes elbows and other necessary fittings with galvanized hanger supports, wooden saddle as per specification and drawings.	Sq.ft					
i.	20 Gauge (Rate Only)	0					
ii.	22 Gauge (Rate Only)	0					
iii.	24 Gauge	6800					



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BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
11	Supply & Installation of 3/4" Foam insulation Thermal Insulation (Fire rating V-0, Density 25Kg/M3). with cladding of internal supply/return air ducts complete with all respect as per specification and drawings. (Rate Only)	0					
12	Supply & Installation of 26Gauge G.I sheet jacketing with 1" Foam insulation Thermal Insulation for EXTERNAL. supply /return air ducts complete with all respects as per (Rate Only)	0					
13	Supply & Installation of 1/2" Foam insulation for Sound liner for supply air ducts complete with all respect as per specification and drawings.	4000					
14	Supply & Installation of Air Devices with damper (Tuttle & Bailey standards] Complete with all respect as per and drawings.						
14a.	Supply, Exhaust & Fresh Air Diffuser (with v.c.d)	Nos.					
i.	6" dia S.A.D	10					
ii.	9" S.A.D	10					
iii	12" dia S.A.D	20					
iv	15" dia S.A.D	5					
v	9" dia E.A.D	36					
14b	Jet type diffusers (with V.C.D)	Nos.					
i	24" dia	0					
14c	Fresh Air Intake Louver (with V.C.D + 0.5" filter)	Nos.					
i	22" x 12"	6					



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BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALATIQN	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
ii	18" x 12"	6					
14d.	Exhaust Air Louver (with V.C.D)	Nos.					
i	36" x 24"	2					
ii	14" x 16"	7					
14e.	Return Air Grill (wih V.C.D)	Nos.					
i	36" x 36"	4					
15	Supply, Installation, Testing & Commissioning of Inverter base Wall Mounted type mini split type A/C unit (T-3 Series) complete with atmosphere friendly refrigerant complete with all respects as per specificalton.	Nos.					
i.	2.0 TR	5					
ii.	1.5 TR	5					
16	Supply, Installation, Testing & Commissioning of Regrigerant for split A/C units with 3/4" thick closed cell foam insulation, cladding, core cutting and chiseling, cutting, hanger support and paint complete with all respect as per specification.	RFT					
i.	2.0 TR	140					
ii.	1.5	140					
17	Removing & Re-fixing of Dampa False Ceiling complete in all respect for piping and ducting work (Labour & Framing only) (if any sheet damaged should be replaced with new one)	SQFT					
i	Dampa False Ceiling Removing & Refixing	16200					



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BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTAtLAtIQN	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
18	Supply, Installation, Testing & Commissioning of additional Regrigerant charging in VRF System as per manufacturer recommendation complete with all respects	1 Job					
19	Supply & Installation of 18" x 18" Aluminium powder quoted access doors complete with all respects.	10 Nos.					
20	All equipment foundation, vibration isolator and equipment lifting, shifting charges from ground floor to foundation pads as per specifcaton and drawings.	1 Job					
21	Supply, Installation, Testing & Commissioning of Fire stoping of walls & structure openings as per specifcation and drawings.	1 Job					
22	Supply of the spares parts & tools for air conditioning system as specifcaiton mentioned in the tender documents.	1 Job					
23	Stencilling, painting & Finishing as per specificaion.	1 Job					
24	M&P services Shop Drawings & As Built Drawings Color Copies. (Minimum scale 1-1/8") Hard Copy & Soft Copy in AutoCAD Format.	4 Sets.					
25	Cost of testing, starting up, commissioning, balancing, adjusting and handling over of the complete plant.	1 Job.					
26	Cost of system operation & Maintenance for 12 operating Months (2 Operators). (from commissioning to Dec-25 & Remaining Time will be completed from Apr-26 to onwards)	1 Job.					



SUKKUR IBA UNIVERSITY

BOQ OF HVAC SYSTEM FOR ACADEMIC BLOCK - V, SIBAU

S.No.	DESCRIPTION	QTY	UNIT RATE (US)		AMOUNT(RS)		TOTAL COST
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTAtLAtIQN	
1	2	3	PKR 4	PKR 5	PKR 6	PKR 7	PKR 8
27	COST OF ANY OTHER ITEM WHICH IS MISSING AND NECESSARY TO COMPLETE THE JOB. (DETAIL MUST BE ATTACHED).	-					
TOTAL COST OF HVAC SYSTEM (RS.) INCLUDING ALL TAXES							

Amount in Words: _____

Notes:

- 1 The Contractor shall be responsible for the supply, procurement and delivery of all the material and shifting of the equipment to their respective location, installation, testing, commissioning of the systems in all respects.
- 2 The quoted cost should include all overheads, profits, income tax and all other Taxes which are applicable, import duty (if any), insurance, packing, unpacking, transportation charges etc.
- 3 The work at site shall be executed in accordance with the approved shop drawings which will be prepared by the Contractor.
- 4 The work at site shall be executed in accordance with the approved shop drawings which will be prepared by the Contractor within 2 week after award of works and Manufacturers drawings, Contract Specifications etc.
- 5 The work shall be awarded on item Rate cost basis.
- 6 The bidder will provide all equipment software soft copy to the client.
- 7 The bidder will train client operator for equipment Operation and servicing etc.
- 8 The complete system replacement warranty should be 1years.
- 9 The contractor will provide Equipment Operation & Maintenance Manuals (2 sets Hard copy & Soft Copy.)
- 10 The contractor will provide Operation & Maintenance Instructions to Clients Representatives
- 11 The Owner reserves the right to delete any item before award of works. The cost of such items shall be reduced.
- 12 Abbreviation used in the BOQ are as follows:
a) Sq. Ft. Square Feet, (b) R. Feet. Running Feet, (c) Ton Ton weight, (d) TR Ton of refrigeration, (e) No. Number, (f) Lot Complete package/lump sum.





SUKKUR IBA UNIVERSITY

PROJECT NAME

HVAC SYSTEM FOR ACADEMIC BLOCK - V SUKKUR IBA
UNIVERSITY

PROJECT STATUS

TENDER

PROJECT NO.

DATE

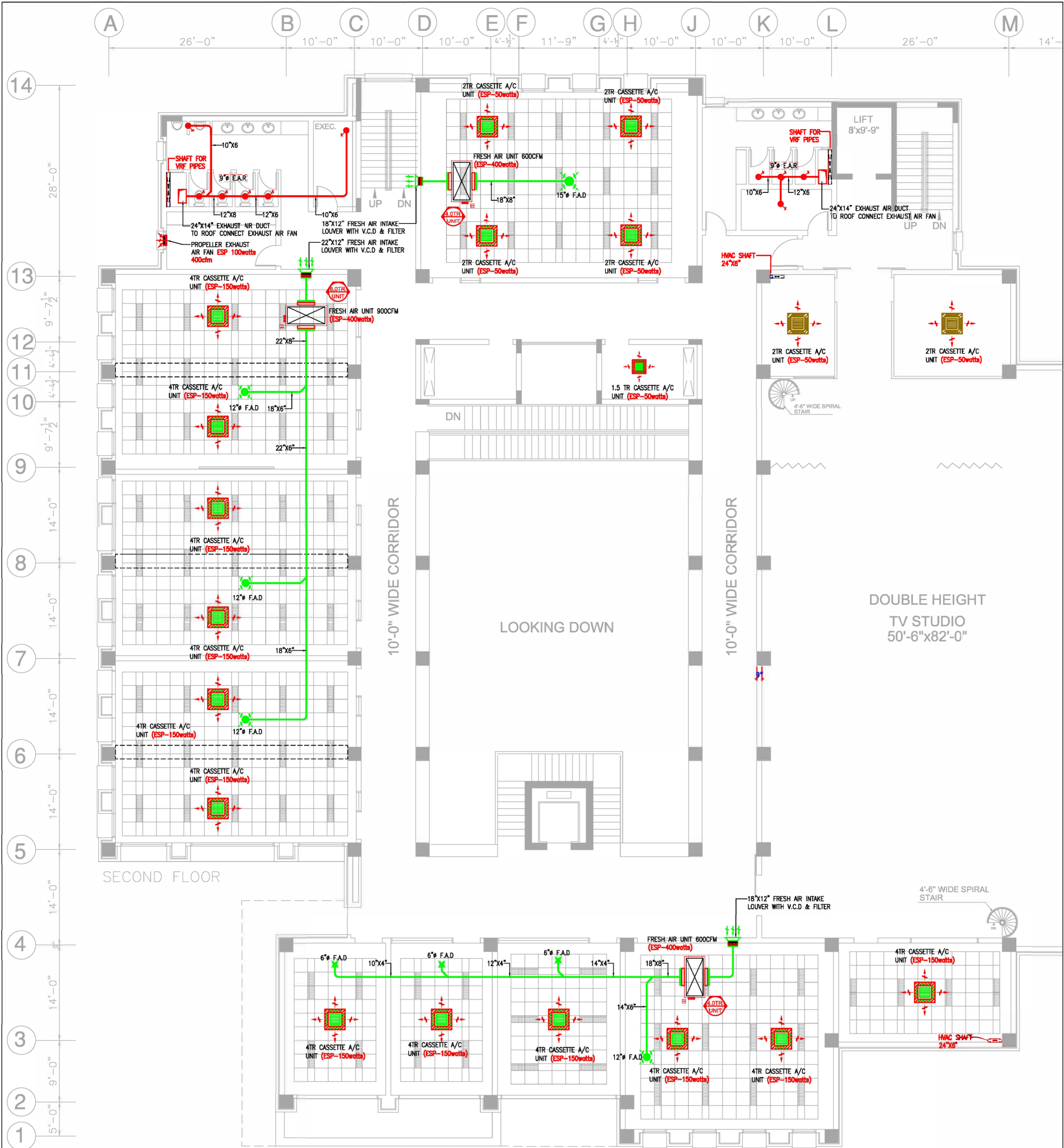
JAN - 2025



LIST OF DRAWINGS				
S. NO	DRAWING NOs	DESCRIPTION	SCALE	DATE
01	H-01	LAYOUT OF PROPOSED INDOOR A/C PLACEMENT & VRF / DRAIN PIPING SYSTEM AT BASEMENT LEVEL	AS SHOWN	
02	H-02	LAYOUT OF PROPOSED INDOOR A/C PLACEMENT & VRF / DRAIN PIPING SYSTEM AT GROUND FLOOR	AS SHOWN	
03	H-03	LAYOUT OF PROPOSED INDOOR A/C PLACEMENT & VRF / DRAIN PIPING SYSTEM AT FIRST FLOOR	AS SHOWN	
04	H-04	LAYOUT OF PROPOSED INDOOR A/C PLACEMENT & VRF / DRAIN PIPING SYSTEM AT SECOND FLOOR	AS SHOWN	
05	H-05	LAYOUT OF PROPOSED INDOOR A/C PLACEMENT VRF / DRAIN PIPING & A/C EXHAUST AIR DUCTING SYSTEM AT THIRD FLOOR	AS SHOWN	
06	H-06	LAYOUT OF PROPOSED FRESH AIR DUCTING SYSTEM AT BASEMENT LEVEL	AS SHOWN	
07	H-07	LAYOUT OF PROPOSED FRESH AIR & EXHAUST DUCTING SYSTEM AT GROUND FLOOR	AS SHOWN	
08	H-08	LAYOUT OF PROPOSED FRESH AIR & EXHAUST DUCTING SYSTEM AT FIRST FLOOR	AS SHOWN	
09	H-09	LAYOUT OF PROPOSED FRESH AIR & EXHAUST DUCTING SYSTEM AT SECOND FLOOR	AS SHOWN	
10	H-10	LAYOUT OF PROPOSED A/C OUTDOOR PLACEMENT AT ROOF PLAN	AS SHOWN	
11	H-11	M.C.C DETAIL	AS SHOWN	
12	H-12	SCHEDULE OF EQUIPMENTS	AS SHOWN	
13	H-13	HVAC GENERAL NOTES	AS SHOWN	
14	H-14	HVAC GENERAL DETAIL	AS SHOWN	
15	H-15	BUILDING SECTIONAL DETAIL	AS SHOWN	

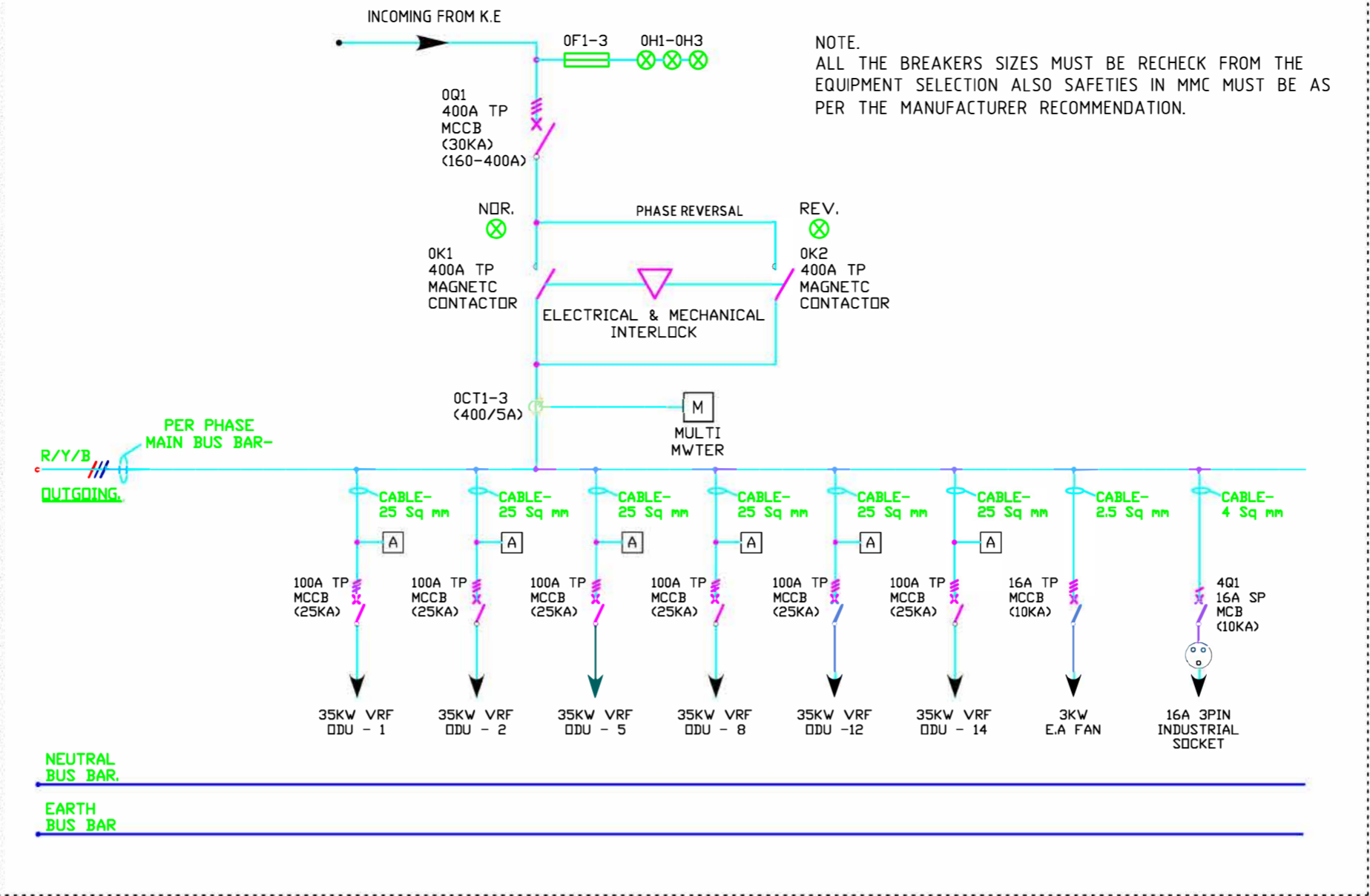


SYMBOLS	DESCRIPTION	SYMBOLS	DESCRIPTION
	CASSETTE INDOOR A/C UNIT		FRESH AIR DUCT
	FRESH AIR DIFFUSER		EXHAUST AIR DUCT
	EXHAUST AIR REGISTER		SUPPLY AIR DUCT
	BALL SPOT SUPPLY AIR JET DIFFUSER		RETURN AIR DUCT
	RETURN AIR GRILL		REFRIGERANT CABLE TRAY
	VOLUME CONTROL DAMPER & FILTER		UN1 VRF REFRIGERANT UNIT-01
	FRESH AIR INTAKE LOUVER		UN2 VRF REFRIGERANT UNIT-02
	EXHAUST AIR LOUVER		UN3 VRF REFRIGERANT UNIT-03
			UN4 VRF REFRIGERANT UNIT-04
			A/C DRAIN PIPE
			BURIED A/C DRAIN PIPE
			A/C DRAIN PIPE
			PROPELLER EXHAUST AIR FAN
			ELECTRIC SUPPLY POINT WITH ISOLATION BREAKER PROVIDED BY ELECTRICAL CONTRACTOR.

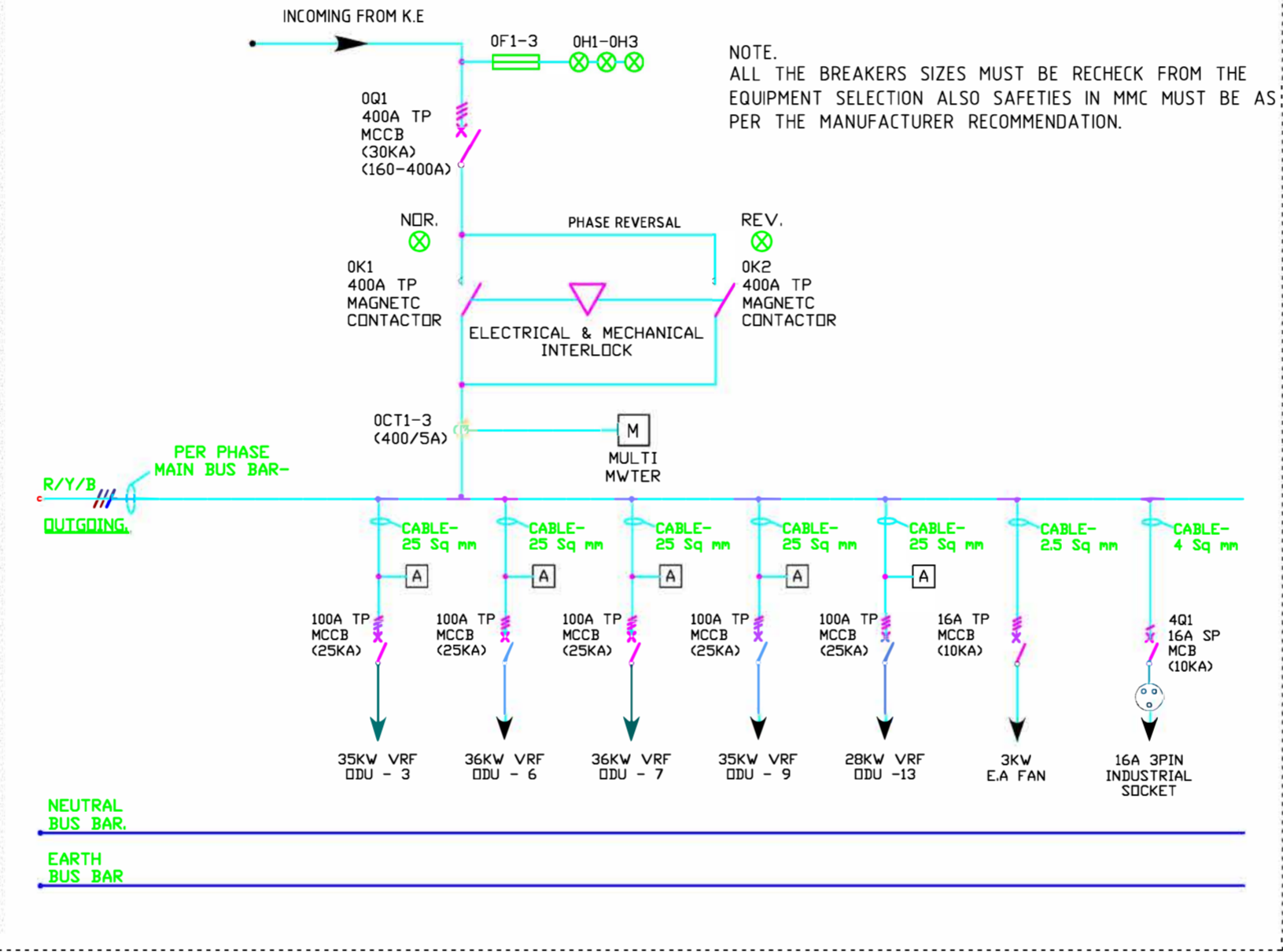


SYMBOLS	DESCRIPTION	SYMBOLS	DESCRIPTION
	CASSETTE INDOOR A/C UNIT		FRESH AIR DUCT
	FRESH AIR DIFFUSER		EXHAUST AIR DUCT
	EXHAUST AIR REGISTER		SUPPLY AIR DUCT
	BALL SPOT SUPPLY AIR JET DIFFUSER		RETURN AIR DUCT
	RETURN AIR GRILL		REFRIGERANT CABLE TRAY
	VOLUME CONTROL DAMPER & FILTER		UN7 VRF REFRIGERANT UNIT-07
	FRESH AIR INTAKE LOUVER		UN10 VRF REFRIGERANT UNIT-10
	EXHAUST AIR LOUVER		UN11 VRF REFRIGERANT UNIT-11
			UN12 VRF REFRIGERANT UNIT-12
			UN13 VRF REFRIGERANT UNIT-13
			A/C DRAIN PIPE
			BURIED A/C DRAIN PIPE
			A/C DRAIN PIPE
			PROPELLER EXHAUST AIR FAN
			ELECTRIC SUPPLY POINT WITH ISOLATION BRACKET PROVIDED BY ELECTRICAL CONTRACTOR.

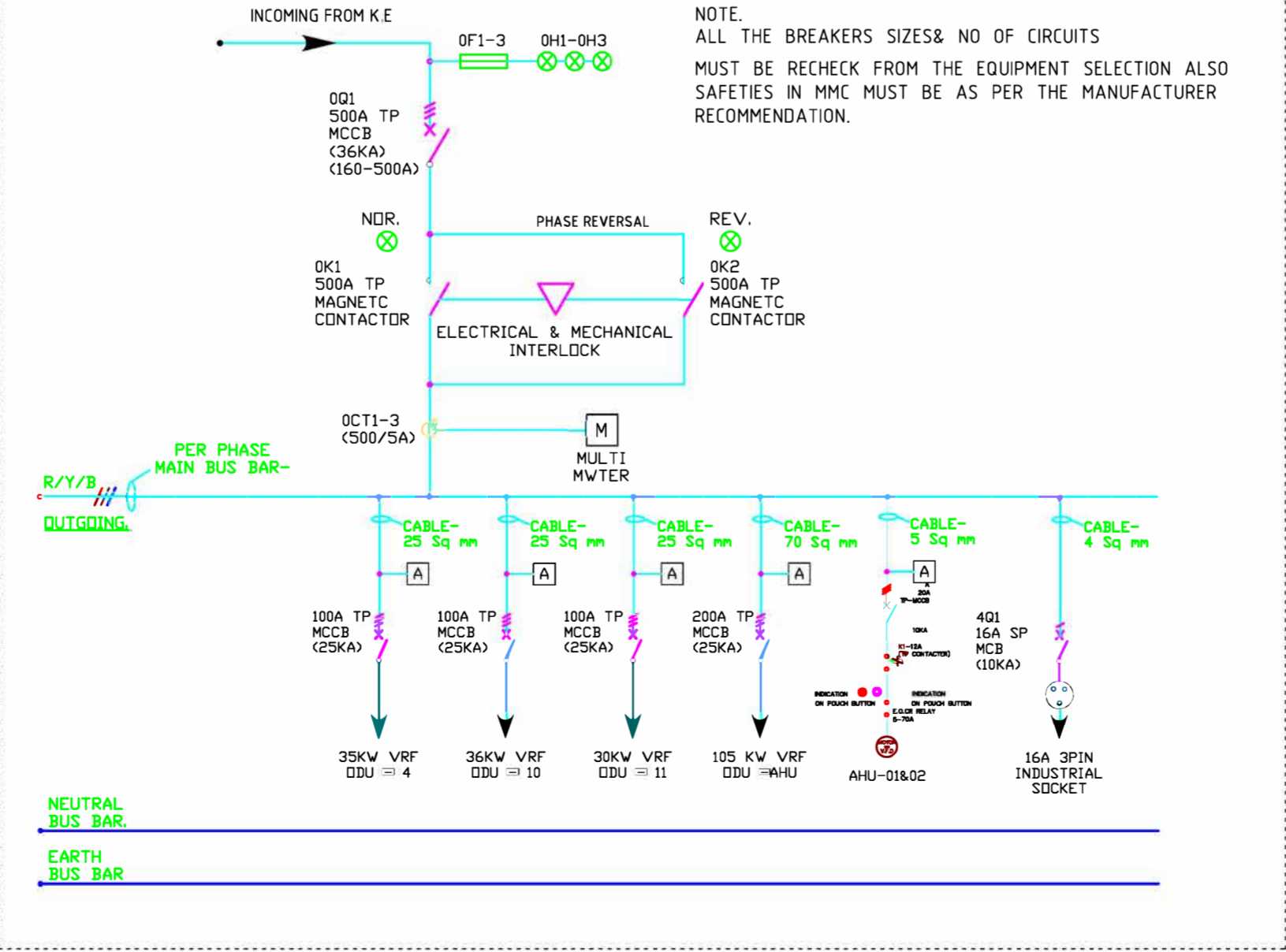
MCC-01



MCC-02



MCC-03



VRV SCHEDULE									
S.NO	FLOOR	VRV NO.	INDOOR TYPE	TR	QTY	CAPACITY (CONNECTED LOAD)	REMARKS		
1	BASEMENT	1	Cassette	1	3	31			
				3	2				
				4	4				
			F.A UNIT	6	1				
2	BASEMENT	2	Cassette	3	7	31			
				4	1				
			F.A UNIT	6	1				
3	BASEMENT	3	Cassette	3	1	31			
				4	6				
			F.A UNIT	4	1				
4	BASEMENT	4	Cassette	2	1	31			
				3	2				
				4	1				
	GROUND		Cassette	4	1				
				1	5				
				2	1				
				4	2				
5	GROUND	5	Cassette	1	5	31			
				2	1				
				3	2				
				4	3				
			F.A UNIT	6	1				
6	GROUND	6	Cassette	3	2	32			
				4	4				
	1ST FLOOR		Cassette	6	1				
				4	1				
7	GROUND	7	Cassette	2	4	32			
	1ST FLOOR			2	4				
	2ND FLOOR		F.A UNIT	4	1				
			Cassette	2	4				
			F.A UNIT	4	1				
8	GROUND	8	Cassette	4	3	30			
	1ST FLOOR			1.5	4				
				3	4				
9	1ST FLOOR	9	Cassette	3	3	31			
				4	4				
			F.A UNIT	6	1				
10	1ST FLOOR	10	Cassette	4	2	32			
	2ND FLOOR			4	5				
	F.A UNIT		4	1					
11	2ND FLOOR	11	Cassette	4	1	27			
	3RD FLOOR			3	1				
				4	5				
12	2ND FLOOR	12	Cassette	4	6	30			
			F.A UNIT	6	1				
13	2ND FLOOR	13	Cassette	2	2	19			
	3RD FLOOR			2	3				
				3	3				
14	1ST FLOOR	14	Cassette	1.5	2	20			
				3	3				
				4	1				
			F.A UNIT	4	1				
1	INDOOR CONDITION- 23 DEGREE C (50%R.H)								
2	OUT DOOR DESIGN CONDITION- 45 DEGREE.C (UNIT OPERATIONAL RANGE-T3. -7TO+52DEGREE								
3	THE VRV UNITS SHOULD BE HIGH EFFICIENCY AND THE MINIMUM EER(W/W) MUST BE 4.0								



PROJECT NAME		ARCHITECT	M&P CONSULTANT	REVISION	DATE	DESCRIPTION	DRAWING TITLE	PROJECT NO. SIBAU(AB)-2020-29		DRAWING SHEET		
SUKKUR IBA UNIVERSITY CAMPUS - 01 ACADEMIC BLOCK - V								DRAWING NO.	H-12			
								DRAWING SCALE.	N.T.S			
								DATE.	MARCH-2021			
								DRAW BY.	MTF			
							SCHEDULE OF EQUIPMENTS	CHECKED BY.	ZD	A-2		

TENDER DRAWING

GENERAL NOTES

1. THE MECHANICAL SYSTEM SHALL CONSIST OF ALL WORKS SHOWN ON THE DRAWINGS, INCLUDING PLANS, DIAGRAMS, DETAILS ETC., AND ALL WORKS AS IDENTIFIED IN THE SPECIFICATIONS. WORK INCLUDES FURNISHINGS, INSTALLING SYSTEM INTEGRATION, TESTING, TRAINING AND WARRANTY OF THE MECHANICAL SYSTEM AS SHOWN AND SPECIFIED. PROVIDE A COMPLETE AND WORKABLE MECHANICAL SYSTEM COMPLETE WITH ALL MECHANICAL AND ELECTRICAL WORKS AS REQUIRED FOR SYSTEM OPERATION.

2. CONTRACTOR SHALL VERIFY ALL SYSTEM AND PERFORMANCE SYSTEM OPERATION AS SPECIFIED.

3. PROVIDE ALL REQUIRED ELECTRICAL POWER, MOTOR, STARTERS, LOCAL ON \ OFF CONTROL AND CONTROL INTERFACE AND CONNECTIONS AS REQUIRED FOR SYSTEM OPERATION COORDI- NATE REQUIREMENTS WITH ELECTRICAL.

4. PROVIDE ALL REQUIRED EQUIPMENT GUARDS AND STRUCTURAL SUPPORT AS RECOMMENDED BY EQUIPMENT MANUFACTURERS TO SUPPORT EQUIPMENT AND TO ASSURE SYSTEM PERFORMANCE AND SAFE OPERATION. COORDINATE PRIOR TO INSTALLATION.

5. COORDINATE LOCATION WITH ARCHIT.OF ALL THERMOSTATS AND ALL WALL MOUNTED EQUIPMENT. LOCATIONS AS SHOWN ON THE DRAWINGS ARE FOR REFERENCE ONLY.

6. REFERENCE THE REFLECTED CEILING PLANS FOR LOCATION OF GRILLES, REGISTERS, DIFFUSERS AND OTHER CEILING MOUNTED DEVICESUNITS. MOUNT EQUIPMENT IN CONFORMANCE WITH ARCHITECTURAL FEATURES, IN THE CENTER OF CEILING TILES, IN THE CENTER OF ROOMS OR CORRIDORS OR WHERE SHOWN ON ARCHITECTURAL DRAWINGS. WHERE EQUIPMENT IS NOT SHOWN ON ARCHITECTURAL DRAWINGS PROVIDE SHOP DRAWINGS SHOWING PROPOSED CEILING LOCATIONS.

7. LOCATION AND DETAILS OF EQUIPMENT CONNECTIONS ARE APPROXIMATE. COORDINATE THIS INFORMATION WITH THE CONTRACTOR FURNISHINGS THE EQUIPMENT AND ADJUST INSTALLATION DETAILS PRIOR TO ROUGH-IN.

8 ALL MECHANICAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH GENERAL NOTES, SPECIFICATIONS AND MISCELLANEOUS DETAILS.

9 UNLESS OTHERWISE SPECIFIED, ALL DUCT SIZES AND OTHER DIMEN- SIONS ARE IN INCHES.

10. FIRE DAMPERS:(IF APPLICABLE)

10.1 PROVIDE APPROVED FIRE DAMPERS WHERE DUCTS OR AIR GRILLES PENETRATE PARTITIONS AND FLOOR REQUIRED TO HAVE A FIRE RESISTANCE RATING OF 2 HOURS OR MORE.

10.2 PROVIDE ACCESS DOORS ON ALL FIRE / SMOKE DAMPERS.

11. ALL DUCT/PIPE SIZES MENTIONED ON PLANS ARE CLEAR SIZES, EX- CLUDING THE THICKNESS OF INSULATION AND OTHER DUCT LINING.

12. DUCT INSULATION:

12.10 ALL SUPPLY DUCTS BE INSULATED.

12.20 GENERALLY, ALL RETURN DUCTS SHALL NOT BE INSULATED EXCEPT THOSE EXPOSED TO WEATHER, LOCATED NEAR LIGHTING FIXTURES AND THOSE PASSING THROUGH NON-AIR CONDITIONED SPACES.

12.30 FRESH AIR AND EXHAUST DUCTS PASSING THROUGH AIR CONDITIONED SPACES SHALL BE INSULATED.

13. PROVIDE 12mm SQUARE MESH SCREEN ON ALL BELLMOUTH OPENINGS IN CEILING SPACE.

14 DUCTWORK, FITTINGS, HANGERS AND ACCESSORIES SHALL BE AS PER SMACNA RECOMMENDATIONS.

15 INSTALL VOLUME DAMPERS ON ALL DUCT BRANCHES AND BRANCH TAKE-OFFS AND WHEREVER REQUIRED FOR PROPER BALANCING OF AIR.

16 ALL THE COPPER PIPES SHALL BE RUN THRU BEAM CORE. THE BEAM,WALL,ROOF OPENINGS SHALL BE 10mm LARGER ALL AROUND THAN DUCT SLEEVE PASSING THROUGH WALL OR SLAB AND THE VOID WILL BE FILLED WITH NON-COMBUSTIBLE MATERIAL.

17 COORDINATE GRILLES, DIFFUSERS AND REGISTERS WITH REFLECTED CEILING PLANS AND LIGHTING PLANS.

18 REFER TO ARCHITECTURAL DRAWINGS FOR DOOR GRILLES AND DOOR UNDERCUT SIZES AND DETAILS.

19 FAN SYSTEM RESISTANCES STATED IN THE SCHEDULES ARE DESIGN APPROXIMATIONS ONLY AND SHALL BE CHECKED BY THE MECHANICAL SERVICES CONTRACTOR PRIOR TO THE FINAL ORDERING OF EQUIPMENT.

20 ALL PIPES PIPES SHALL BE INSULATED AS PER SPECIFICATIONS.
- 21 PIPE ALL CONDENSATE DRAIN LINES OF AHU'S TO THE NEAREST DRAIN POINT PROVIDED UNDER PLUMBING WORKS UNLESS OTHERWISE SHOWN ON THE DRAWING.

22 PROVIDE SHUT OFF AND BALANCING VALVES IN THE CHILLED WATER PIPING AT ALL BRANCHES AND WHERE REQUIRED FOR PROPER BALANCING AND MAINTENANCE.

23 PROVIDE SLEEVES WHERE PIPES PENETRATE WALLS AND SLABS.

24 WHERE SHOW ON PLANS THE ROOM THERMOSTATS SHALL BE MOUNTED ON THE WALL @ 1.5 METER ABOVE FINISHED FLOOR LEVEL.

25 ROOF MOUNTED EQUIPMENT TO BE TROPICALIZED AND WATER PROOFED.

26 VIBRATING EQUIPMENT SHALL BE PROVIDED WITH ISOLATORS TO PREVENT VIBRATION TRANSMISSION.

27 INSTALL ALL EQUIPMENT AS PER MANUFACTURE'S RECOMMENDATIONS.

28 SIZES AND TYPE OF RETURN DIFFUSERS SHALL BE THE SAME AS THEIR RESPECTIVE SUPPLY DIFFUSER IN THE SAME ROOM SERVED UNLESS OTHERWISE SHOWN ON THE DRAWING.

29 DESIGN CONDITIONS:

29.1 INDOOR CONDITIONS:

A. SUMMER - 23 C DB / 50%RH

29.2 OUTDOOR CONDITIONS:.

A. SUMMER - 45 C DB

30 THE CONTRACTOR SHALL VERIFY CEILING LAYOUT AND COORDINATE THE UNITS PLACEMENT DIFFUSER.

31 THE CONTRACTOR SHALL HAVE THE OPTION TO USE EXTENSIVELY CIRCULAR DUCTS WHENEVER POSSIBLE.

32 PROVIDE FIRE RETARDANT FLEXIBLE JOINT WHERE DUCTS PASS THROUGH CONSTRUCTION JOINT.

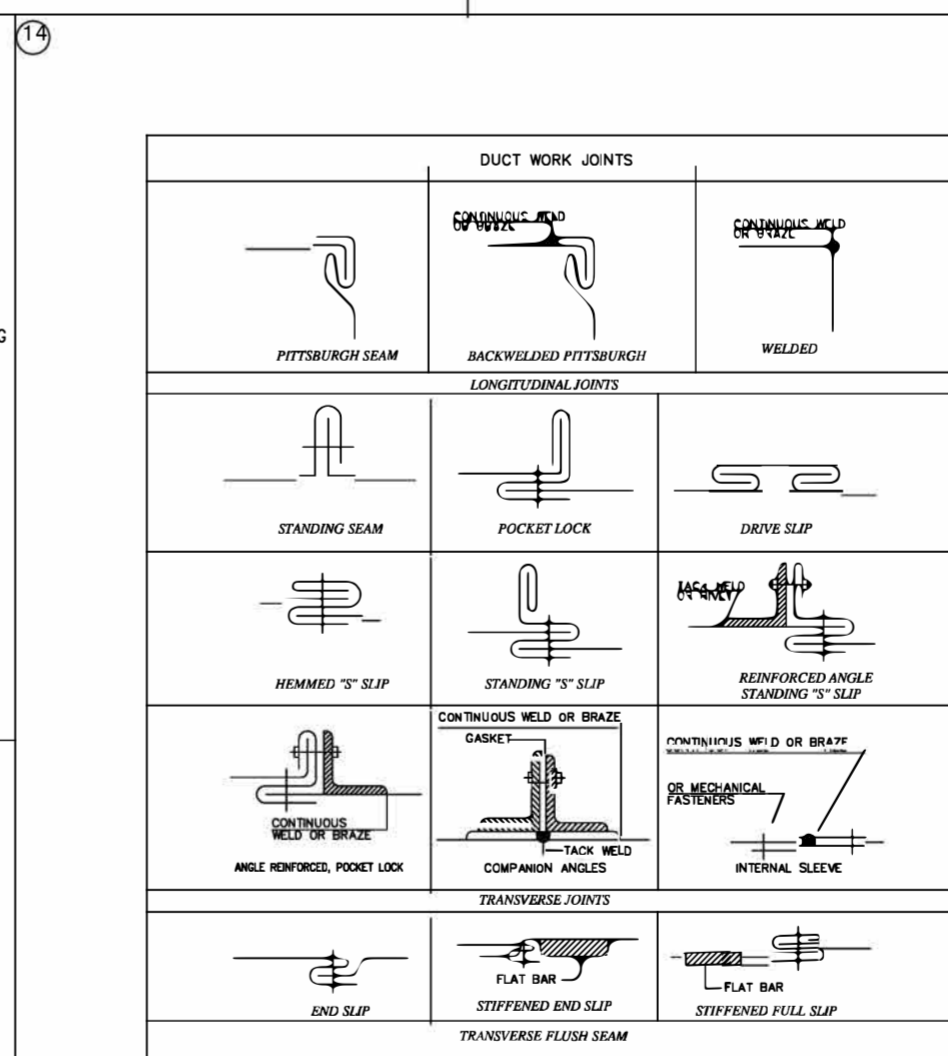
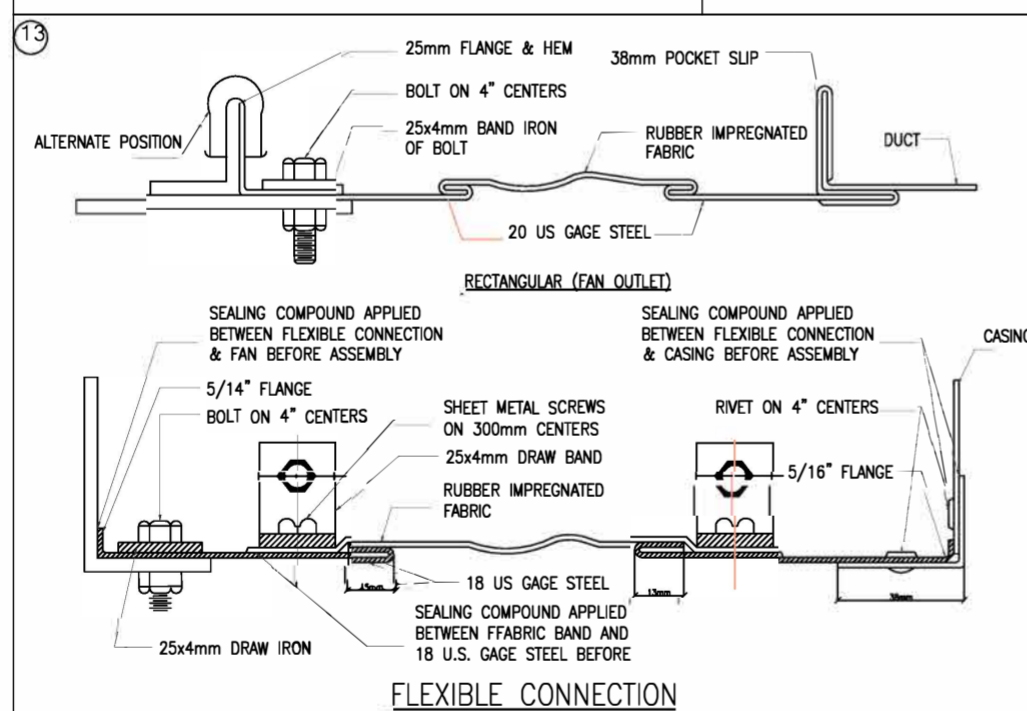
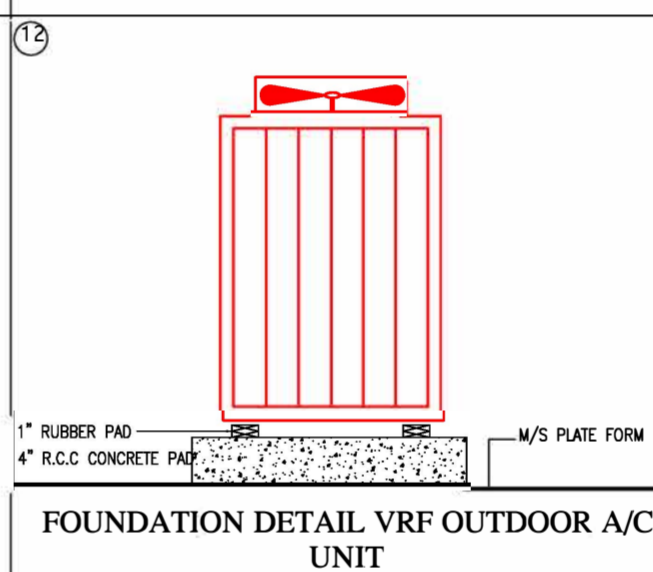
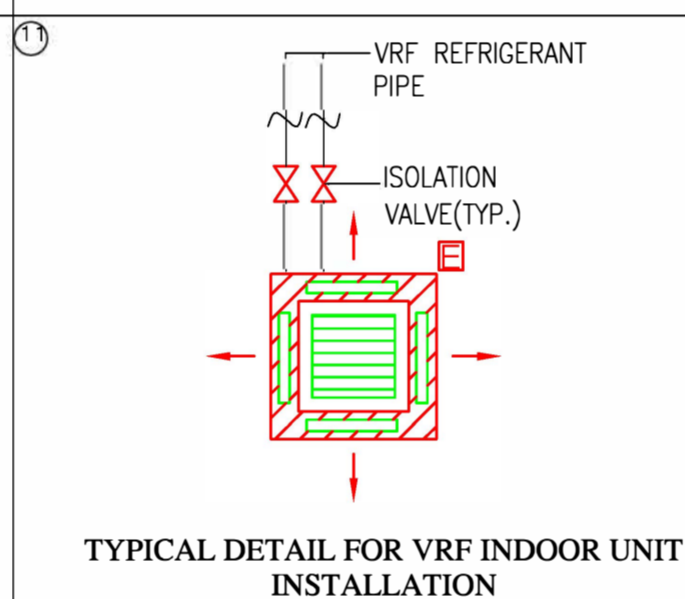
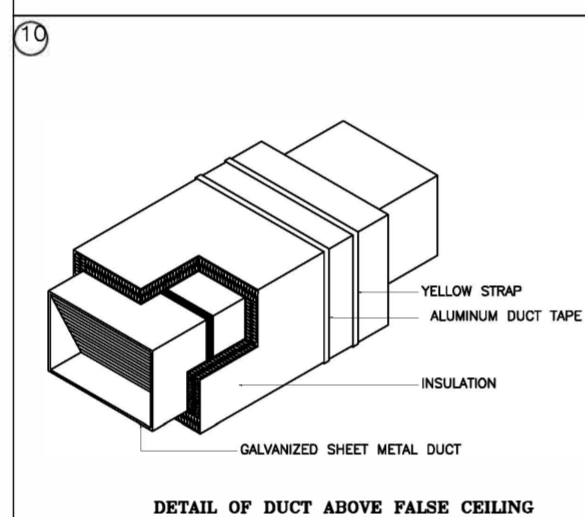
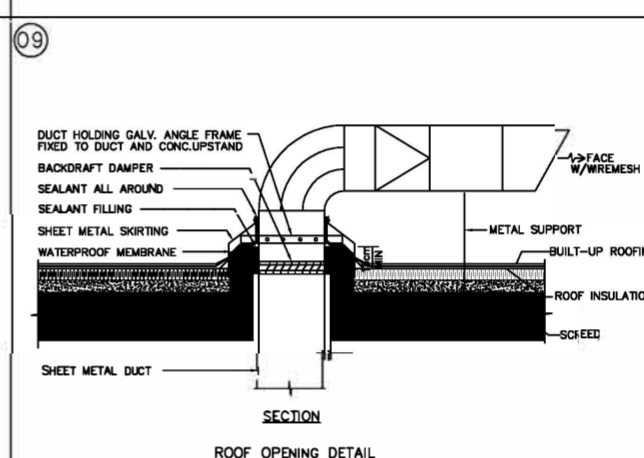
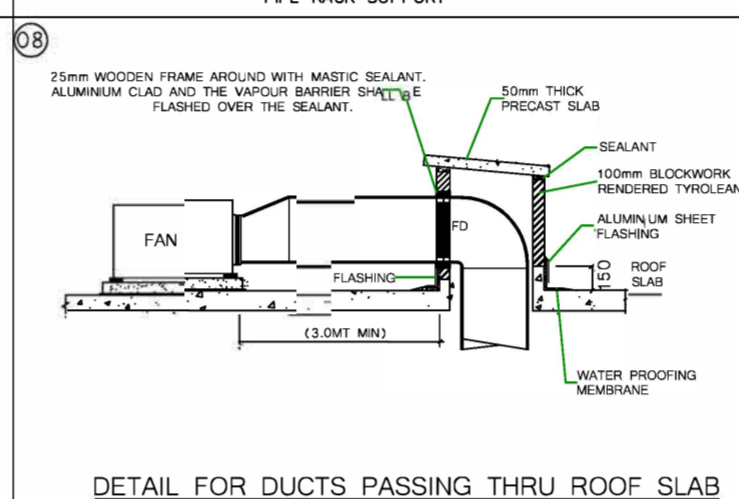
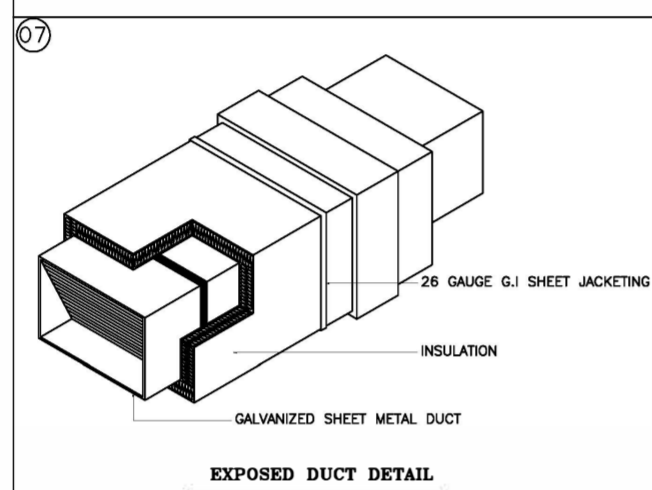
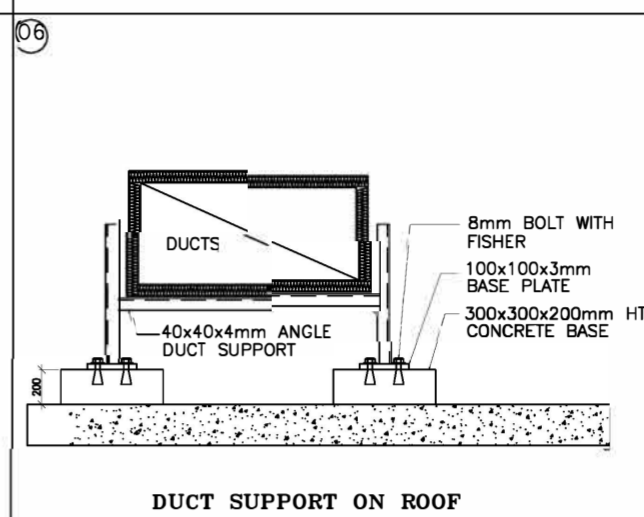
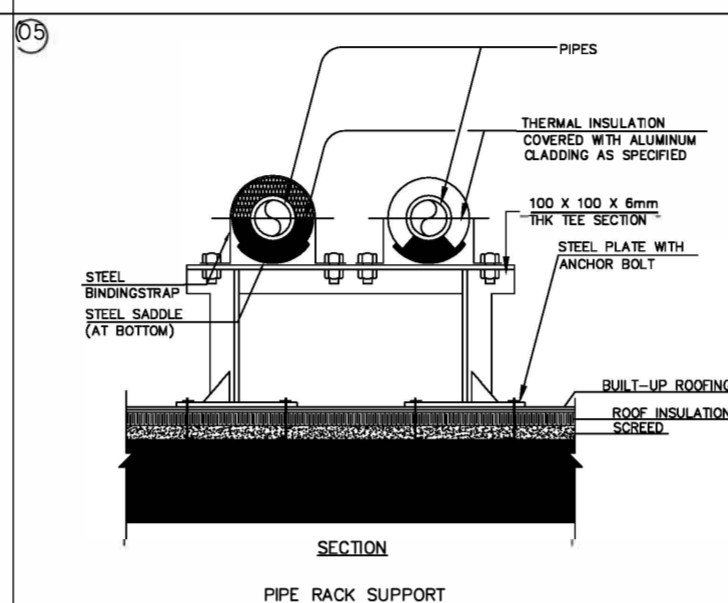
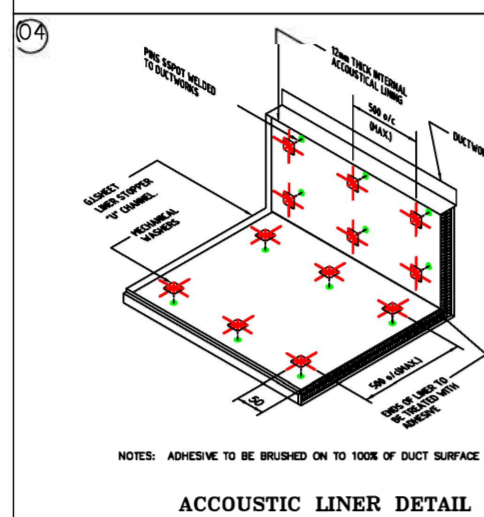
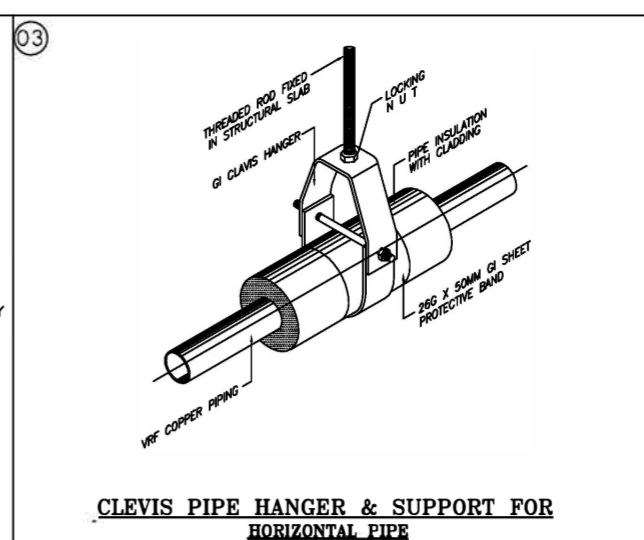
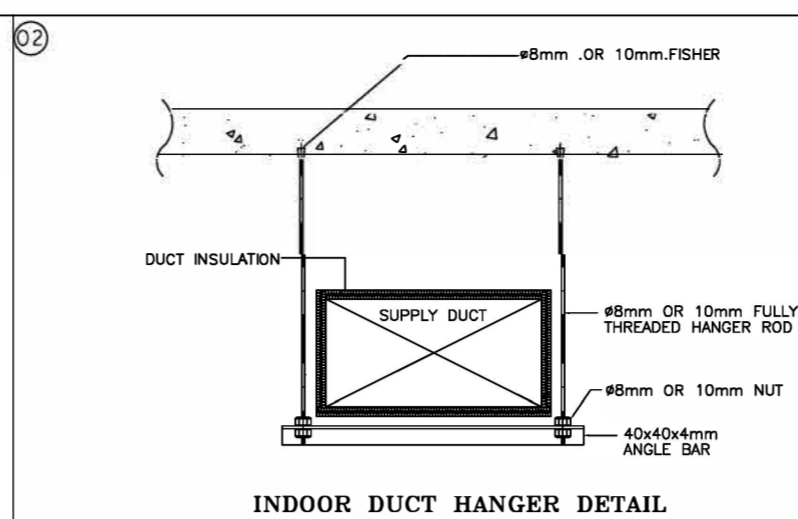
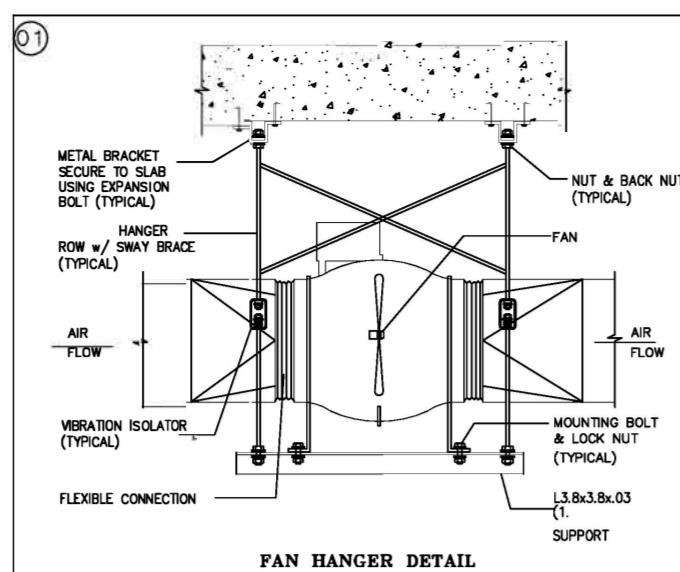
33 THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DETAILED ARRANGEMENT OF ALL PIPING, VALVES, VIBRATION ISOLATORS, ETC. AT THE AHU CONNECTIONS GIVING DUE IMPORTANCE TO MAINTENANCE ACCESS TO FANS & MOTORS COOLING COILS INCLUDING ITS PULL-OUT AND FILTERS. PROVIDE U-TRAP WITH SUFFICIENT DEPTH AT ALL AHU CONDENSATE DRAINS. PIPE ALL DRAINS TO NEAREST FLOOR OR RAIN WATER DRAIN.

34 CONTRACTOR SHALL PROVIDE WORKING SHOP DRAWING SHOWING ALL SUPPORTS OF DUCTWORKS & EQUIPMENT.

35 ALL EQUIPMENT EXPOSED TO WEATHER SHALL BE SUITABLE FOR OUTDOOR INSTALLATION.

36 ALL AHU/FCU DRAINS SHALL BE PIPED TO THE NEAREST DRAIN PROVIDE BY THE PLUMBING CONTRACTOR.

37 CONTRACTOR SHALL PROVIDE WORKING / SHOP DRAWING SHOWING ALL SUPPORTS OF DUCTWORKS & EQUIPMENT.



METAL GAGE		TRANSVERSE JOINTS			HANGERS		
GALVANIZED STEEL		CONSTRUCTION	SPACING FEET	TRANSVERSE BRACING	R.O.D. DIA.	SHELF ANGLE	MAX. SPACING
26	10" THRU 12"	1" POCKET LOCK HEMMED "3" S.L.P. (VERTICAL ONLY)	8'	NONE	3/8"	1/2"x2-1/2" / 1"x2"	
24	13" THRU 30"	1" POCKET LOCK HEMMED "3" S.L.P. 1" BAR SLP	8'	NONE	3/8"	1"x1/8" STRAP	8'-0"
22	31" THRU 42"	1" POCKET LOCK STANDING "3" S.L.P. 1" REINFORCED BAR SLP	8'	NONE	3/8"	1/2"x2-1/2" / 1"x2"	6'-0"
22	43" THRU 54"	1-1/2" POCKET LOC STANDING "3" S.L.P. 1-1/2" REINFORCED BAR SLP	8'	NONE OR CROSS BREAK	1/2"	2"x2"x1/8" OR EQUIVALENT CHANNEL	6'-0"
20	55" THRU 80"	1-1/2" REINFORCED BAR SLP 1-1/2" STANDING "3" S.L.P.	8'	1/2"x2-1/2" / 1"x2/8" ANGLE CENTERED BETWEEN JOINTS	1/2"	2"x2"x1/8" OR EQUIVALENT CHANNEL	4'-0"
20	81" THRU 84"	1-1/2" ANGLE REINFORCED POCKET LOCK	8'	1/2"x2-1/2" / 1"x2/8" ANGLE CENTERED BETWEEN JOINTS	1/2"		
18	85" THRU 98"	1-1/2" REINFORCE BAR SLP 1-1/2" ANGLE REINFORCED POCKET LOCK 1-1/2" COMPANION ANGLES	4'	1/2"x2-1/2" / 1"x2/8" ANGLES CENTERED BETWEEN JOINTS	1/2"	5"x3"x1/4"	4'-0"
18	99" THRU 120"	2" ANGLE REINFORCED POCKET LOCK 2" COMPANION ANGLES	4'	2"x2"x1/4" ANGLES CENTERED BETWEEN JOINTS			
			8'	2"x2"x1/4" ANGLE ON 2'-0" CENTERS			

