TENDER DOCUMENT

(e-Procurement)

Tender No: IISc/Tender-ELE-01/2025-26

For

" Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore."

Office of the Project Engineer cum Estate officer

Centre for Campus Management and Development Indian Institute of Science

Indian Institute of Science Bangalore – 560012

080-2293-2202/2008

Website :https://iisc.ac.in/all-tenders/

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1. **Tender Notification**

Tender No: IISc/Tender-ELE-01/2025-26

Name of work	**Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore.**
Estimated Value of work	**Rs.12,61,08,627./-**
Period of Work Completion	**9 Months**
Name of the Client	Indian Institute of Science, Bangalore
Address of the Client	The Registrar Indian Institute of Science Bangalore – 560 012 Tel No. 080-2293 2008/2202 e-mail: office.ccmd@iisc.ac.in
Submission of Tender Document	e-procurement portal- https://eprocure.gov.in/eprocure/app Helpline no: 0120-4001005
Earnest Money to be deposited with the Tender	**Rs.12,61,086.00** (1% of the Estimated Cost)
Last date and Time for online submission (uploading) of tender	**14.05.2025 at 1530Hrs**
Date and Time of opening of Tender (Technical Bid)	**15.05.2025 at 1530Hrs**
Date and Time of opening of Tender (Financial Bid)	Shall be intimated to technically qualified bidders thro' CPP portal.
Pre-bid meeting Date, Time & Venue	**05.05.2025 at 1200Hrs** Pre bid meeting will be held on Teams App. The web link will be forwarded to the intending bidders. They are requested to send the request to the email id: office.ccmd@iisc.ac.in **Queries can be mailed in prior to the same mail.**

2.Notice Inviting Tender

The Registrar, Indian Institute of Science invites tenders in two bids (Technical and Financial) system from eligible Bidders, for **"Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore."**

Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of India or any State Government of Union of India. (Authorized signatory should provide an undertaking). Tenders from Joint ventures are not acceptable.

2.1 All Bidders shall provide the required information accurately and enough as per details in Section 4:Eligibility Criteria

2.2 The Tenderer shall upload the valid copies of the documents as mentioned in the Chapter-4 (Eligibility criteria) in technical bid**, failing which the tender will be rejected**. If necessary, bidder shall produce all the original documents for verification.

2.3 The work shall be carried out as per the directions of the Project Engineer cum Estate Officer.

2.4 Blacklisted contractors inState / Central Govt. Departments / BBMP / PSU/ Central PSUs/ Autonomous bodies / Institutions are not eligible to quote, if found such tenders will be rejected.

2.5 The successful Bidder shall execute an Agreement within 10 days from the date of Receipt of intimation from this office, The Tender Document will form the part and parcel of the agreement, failing which the tender will deem to be get cancelled.

2.6 The material shall be got approved by the Project Engineer cum Estate Officer, IISc before execution of the work.

2.7 Further details of the work can be obtained from this office.

2.8 The rates quoted should reflect all taxes. The bid evaluation will be done inclusive of all Taxes / Cess. / Royalty etc. The statutory levies as per Govt. guidelines will be deducted. The IISc reserves the right to accept / reject any or all the tenders without assigning any reasons.

2.9 The work shall be commenced with all manpower, material, machinery & requisite resources within 10 days from the date of workorder, failing which it would be presumed that the successful tenderer is not interested in the work and action will be taken to get the work executed through alternate agency at the risk and cost of the former Tenderer.

2.10 Conditional tenders will not be accepted and is liable for rejection.

2.11 Bidders who meet the specified minimum qualifying criteria, shall be eligible.

2.12 Even though the Bidders meet the eligibility criteria mentioned in Section-4 they are subject to be disqualified if they have:

- Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- Record of poor performance such as abandoning the works, not properly completed the contract, inordinate delays in completion, litigation history, or financial failures etc.

2.15 Site visit:

The Bidder at his own responsibility is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for the Works. The cost of visiting the Site shall be at the Bidder's own expense.

2.16 The Tender document can be downloaded from e-procurement website: https://eprocure.gov.in/eprocure/app. It may be noted that all subsequent notifications, changes and amendments on the project/document would be posted only on the same website. The bidders are advised to visit e-procurement portal and get familiarized with the procedure for submission of the tenders.

2.17 **Content of Tender documents**

The bidders should go through the Tender Document and submit online response through e-procurement portal only.

2.18 Amendment of Tender documents

Before the deadline for submission of tenders, the IISc may modify the tender documents by issuing corrigendum / addendum.

Such corrigendum/ addendum thus issued shall be part of the tender documents and shall be published online in e-Procurement portal.

Prospective Bidders will be given reasonable time for submitting the bid by taking the corrigendum/ addendum into account.

2.19 Documents comprising the Tender

The Technical Bid submitted by the Bidder shall contain the documents as follows:

a) Earnest Money Deposit paid in the specified form as mentioned in the e-Procurement platform.

b) Qualification Information as per formats to comply the task created in the e-Procurement Portal under General Terms and Conditions and Technical parameters and Documents required from Bidder.

c) Any other documents / materials required to be completed and submitted by Bidders in accordance with these instructions. The required documents shall be filled in without exception.

The bidder shall submit the hard copies of the documents / credentials which are uploaded in the tender portal. The documents shall reach the designated office within 3 days from the tender opening date.

The Financial bid shall be submitted by the bidder through e-procurement portal only and no hardcopy of financial bid should be attached or disclosed.

The contract shall be for category of works / whole works based on the priced Bill of Quantities submitted by the Bidder.

All prevailing duties, taxes, and other levies like CESS/Royalty payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Bidder.

2.20 Tender validity

Tenders shall remain valid for a period not less than **180 days** after the deadline date for tender submission. A tender valid for a shorter period shall be rejected by the IISc as non-responsive.

In exceptional circumstances, prior to expiry of the original time limit, the IISc. May request that the Bidders may extend the period of validity for a specified additional period. The request and the Bidders' responses shall be made in writing or by email. A Bidder may refuse the request without forfeiting his earnest money deposit. A Bidder agreeing to the request will not be required or permitted to modify his tender but will be required to extend

the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 2.18 and 2.22 in all respects.

2.21 Earnest money deposit:

The Bidder shall furnish, as part of his tender, earnest money deposit (EMD). The Bidder has to pay the Earnest Money Deposit (EMD) in the form of Demand draft drawn on "The Registrar, IISc" payable at "Bangalore".

The bidder has to scan the demand draft and submit it with Technical Bid Documents for our reference. The original DDs has to be submitted along with the hard copies of all the documents in a sealed cover as a pre-qualification bid (Technical bid) which were uploaded through e-procurement portal.

The EMD amount will have to be submitted by the bidder taking into account the following conditions:

a) The entire amount must be paid in a single transaction.
b) The earnest money deposit of unsuccessful Bidders will be returned after awarding the contract to the successful bidder.

The earnest money deposit may be forfeited:
a) If the Bidder withdraws the tender after tender opening during the period of tender validity,
b) If the Bidder fails within the specified time limit to
i) Sign the Agreement; or
ii) Furnish the required Security deposit

2.22 Provisions for Micro and Small Enterprises (MSE):

The MSE registered bidder should upload the registration certificate in the CPP portal along with the technical bid documents. The MSE registration to specify manufacturing / service of the tender item(s).

Policy is meant for procurement of only goods produced and services rendered by MSEs. However, traders are excluded from the purview of Public Procurement Policy.

Participating Micro and Small Enterprises quoting price within price band of L1+15%, will qualify to supply a portion of requirement by bringing down price to L1 price in a situation where L1 price is from someone other than a Micro and Small Enterprises.

2.23 Format and signing of Tender

Successful Bidder shall sign all the pages of the tender document as a token of acceptance of all the terms and conditions of the contract.

2.24 Submission of Tenders

Tenders must be submitted on-line in the e-Procurement portal by the Bidder before the notified date and time.

2.25 Deadline for submission of the Tenders

The Bidder shall submit a set of hard copies of all the documents in a sealed cover to IISc required as a pre-qualification bid (Technical bid) which were uploaded through e-procurement portal. In the event of any discrepancy between them, the original uploaded document in e-procurement shall govern.

The IISc may extend the deadline for submission of tenders by issuing an amendment, in which case all rights and obligations of the IISc and the Bidders previously subject to the original deadline will then be subject to the new deadline.

2.26 Late Tenders

In e-procurement system, Bidder shall not be able to submit the bid after the bid submission time and date as the icon or the task in the e-procurement portal will not be

available. IISc will not be liable (or) responsible for any delay due to unavailability of the portal and the Internet link.

2.27 Modification and Withdrawal of Tenders

Bidder has all the time to modify and correct or upload any relevant document in the portal till last date and time for Bid submission, as published in the e-procurement portal.

The Bidder may withdraw his tender before the notified last date and time of tender submission. No Tender may be modified after the deadline for submission of Tenders.

Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 2.21 above may result in the forfeiture of the earnest money deposit.

2.28 **Tender Opening:**

The IISc will open all the Tenders received through' online mode, in the presence of the Bidders or their representatives who choose to attend on the specified date, time and place specified. In the event of the specified date of Tender opening being declared a holiday for the IISc. The Tenders will be opened at the appointed time and location on the next working day.

The IISc will evaluate and determine whether each tender meets the minimum qualification eligibility criteria.

Bidder to submit all the Original Documents, which are submitted in e-procurement portal, to the IISc for verification at the time of opening of Tender. The IISc will record the Tender opening.

2.29 Process to be confidential.

Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced.

2.30 Clarification of Tenders

To assist in the examination, evaluation, the IISc may, at his discretion, ask any Bidder for clarification of his Tender. The request for clarification and the response shall be in writing or bye-mail along with the section number, page number and subject of clarification, but no change in the price or substance of the Tender shall be sought, offered, or permitted.

Subject to clause 2.29, no Bidder shall contact the IISc on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the IISc, he/she should do so in writing.

Any effort by the Bidder to influence the IISc in the Tender evaluation, or contract award decisions may result in the rejection of the Bidders' Tender.

2.31 **Examination of Tenders and determination of responsiveness**

Prior to the detailed evaluation of Tenders, the IISc will determine whether each Tender (a) meets the eligibility criteria (b) is accompanied by the required earnest money deposit and; (c) is substantially responsive to the requirements of the Tender documents.

A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the IISc's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Tenders.

If a Tender is not substantially responsive, it will be rejected by the IISc., and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

2.32 Correction of errors

No corrections to uploaded bid is permitted by the portal. Tenders determined to be substantially responsive will be checked by IISc.

2.33 **Evaluation and comparison of Tenders**

Opening of the Financial bid will be preceded by the evaluation of the Pre-qualification Offer (Technical bid), vis-a-vis the capability, capacity and credibility of the Bidder. Evaluation of the Prequalification Offer will be done by the Evaluation Committee constituted for the purpose. After evaluation is completed, all the Bidders who are qualified will be notified and will be intimated at the time of opening of the Financial bid. Financial bid will be opened in the presence of those who choose to be present or even in the absence of any Bidder.

The IISc will evaluate and compare the Tenders asper comparative statement downloaded from e-procurement portal.

In evaluating the Tenders, the IISc. Will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

a) Making any correction for errors and

b) Making appropriate adjustments to reflect discounts or other price modifications offered

The IISc reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the IISc shall not be taken into account in Tender evaluation.

2.34 Negotiations

The Bidder though technically qualified and whose financial offer is the lowest, fails to convince the Tender Evaluation Committee of his capability, capacity, credibility, his offer may be reviewed, and the Bidder intimated accordingly. In such case, the Bidder, who has quoted the lowest price, may be considered and his price may be negotiated as advised by the tender committee.

2.35 Award criteria

Subject to Clause 2.36, the IISc will award the Contract to the Bidder whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price. After technical evaluation the technically qualified bidders will be considered for opening of the financial bids provided that such Bidder has been determined to be eligible in accordance with the provisions of this tender document and subsequent technical clarifications offered by the responsive bidders.

2.36 Right to accept any Tender and to reject any or all Tenders

Notwithstanding Clause 2.35, the IISc reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the IISc's action.

2.37 Notification of award and signing of Agreement

The Bidder whose Tender has been accepted will be notified of the award by the IISc. Prior to expiration of the Tender validity period by e-mail or confirmed by letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the IISc. Will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

The Notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of clause 2.39

The Agreement will incorporate all agreements between the IISc and the successful Bidder /Bidders. It will be kept ready for signature of the successful Bidder in the office of IISc. Following the notification of award along with the Letter of intent. The successful Bidder will sign the Agreement and deliver it to the IISc.

Upon the furnishing by the successful Bidder of the Security deposit, the IISc will issue formal work order.

The successful bidder is required to sign an agreement for the due fulfilment of the contract and start the work immediately on of the acceptance of his tender. A draft of the Articles of the Agreement is enclosed. The Earnest Money will be forfeited and at the absolute disposal of the Employer if the Contractor defaults from signing the Agreement of in starting the work.

2.38 Security deposit (SD)

Further percentage on the running bills and final bill in addition to Earnest Money Deposit shall be levied from the contractor. When the SD deducted from R.A Bills of the contractor **@ 6.5%** of the bill amount exceeds Rs.1.00 Lakh, the amount in excess of Rs. 1.00 Lakh may, at the request of the bidder, be released to him against the production of the bank guarantee issued from a Nationalized/Scheduled bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.

If the security deposit is provided by the successful bidder in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank.

Failure of the successful Bidder to comply with the requirements of clause 2.38 shall constitute sufficient grounds for cancellation of the award and forfeiture of the earnest money deposit.

2.39 Corrupt or Fraudulent practices

The IISc requires that the Bidders observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, IISc.

a) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.

b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a IISc contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a IISc contract.

2.40 Payment Terms

For Civil works: Monthly running account bills.

For Electrical works: 80% against the supply of material and 10% after installation and 10% after testing and commissioning, subject to the other provisions of the tender document.

2.41 Work done as a sub- contractor under a prime contractor will not be considered for qualification. **"Prime Contractor"** means a firm that performs a construction work itself and that the work is directly entrusted to the firm by the owner/ government/ local body/ quasi government/ Government undertaking bodies.

2.42 <u>Make in India</u>

Only "Class–I and Class-II local supplier will be eligible to bid notified vide (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 4th June 2020 amended from time to time.

3.Declaration of Tenderer

Name of Work: **"Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore."**

3.1 I/We, declare that specifications, plans, designs and conditions of contract on which the rates have been quoted are completely studied by me/us before submitting this tender.

3.2 I/We declare that I/We have inspected the work spot and have made myself/ourselves thoroughly conversant and satisfied as regards the field conditions prevalent there, regarding the materials, labour and the particulars of various leads with which the materials required to be brought for the work.

3.3 I/We, declare that the rates quoted for items of works for which now tenders are called for are inclusive of leads with which I/We propose to bring the materials. I/We will not have any claims for higher leads, and my/our quoted rates are with all leads and lifts etc.,

3.4 I/We, declare that the rates tendered by me/us for this work have not been witnessed by any other contractor/s who has/have tendered for this work.

3.5 I/We, declare that I/We, have understood all the conditions mentioned above and also the specifications stipulated in tender condition either by going through myself/ourselves or by getting translated into my/our own mother tongue.

4.**Eligibility Criteria**

Technical Criteria:

4.1–Any specialised firms company registered under KPWD /CPWD/ railways/ MES/ central PSUs/ or any Government department of **Class I/Class A Electrical Contractors** are eligible to apply.

4.2The Bidder should have Experience of having a successfully completed either of the following works:

(a) Three(03) similar completed works each costing not less than **40%** (forty percent) of the estimated cost i.e. **Rs.5,04,43,450.00**

(Or)

(b) Three(02) similar completed works each cossting not less than **60%** (forty percent) of the estimated cost i.e. **Rs.7,56,65,176.00**

(Or)

(c) Three(01) similar completed works each costing not less than **80%** (forty percent) of the estimated cost i.e. **Rs.10,08,86,902.00**

4.3The works should have been completed in last seven (7) consecutive years.

Similar work means work of supply, Installation, Testing and commissioning of HVAC system.

Note: The Experience certificate / work order should be in the same registered name as per Clause 4.1 and not as a joint venture.

HVAC- Biological Science Building: Scope of Work

1. Supply, Installation, Testing and Commissioning of air cooled variable refrigerant flow system comprising of outdoor units and indoor units.

2. Supply, Installation and Testing of copper refrigerant piping complete with fittings, full refrigerant charge and class „O" closed cell elastomer insulation.

3. Supply & Installation of condensate drain piping complete with insulation.

4. Supply, Fabrication and Installation of air distribution system comprising of GSS supply air duct work, extruded aluminum powder coated grilles/ diffuser, insulation etc.

5. Supply, Installation, Testing & Commissioning of associated electrical work comprising of power cabling, control wiring, earthing etc.

6. Balancing, Testing and Commissioning of the entire installation and handing over of system with Training.

7. Civil work of foundation, providing cutouts in slabs, Installation of Ducts and finishing and making good of the above openings/ cutouts.

8. Electrical works like power source to all VRF, cabling between indoor and outdoor to the nearest power points.

9. Dismantling the old VRF units, Ducts and other old HVAC units.

10. Comprehensive AMC for 2 years

Financial Criteria:

4.4 The bidder should have registered for a minimum period of Ten years.

4.5 The average annual financial gross turnover should be **30%** of estimated cost in that last five years.

4.6 The minimum annual financial turnover for the two consecutive years should be **30%** of estimated cost.

4.7 The bidder should have not incurred any loss in more than two years. The bidder should submit the **solvency certificate** from the bank for 30% of estimated cost. The Solvency should not be more than Six-month-Old ending last day of the month, previous to the month in which tender is invited.

4.8 The average net worth of the bidder as of **2024-25** should be not less than 25% of estimated cost. Necessary certificate by the Charted Accountant shall be submitted.

4.9 The bidder should have not been blacklisted by any State / Central Govt. Departments / BBMP / PSU/ Central PSUs/ Autonomous bodies / Institutions.

4.10 The bidding capacity of the bidder should be 75% or more of the estimated cost.

The bidder should possess the bidding capacity as calculated by the following formula.

Available bid capacity = A x M x N -B, where

A = Maximum value of engineering (Civil/ Electrical/ Mechanical as relevant to work being procured)works executed in any one year during the last five years(updated at the current price level), taking into account the completed as well as works in progress.

M = Multiplier Factor (usually 1.5)

N = Number of years prescribed for completion of the work in question.

B = Value (updated at the current price level) of the existing commitments and ongoing works to be completed in the next 'N' years.

4.11 Information on works for which tenders have been submitted and ongoing works as on the date of this Tender.

(A) Existing commitments and on-going works:

Description ofwork	Place & State	Contract number & date	Name & address ofthe customer	Value of Contract in Lakhs	Stipulated period of completion	Value of work remaining to be completed in Lakhs	Anticipated date of completion
1	2	3	4	5	6	7	8

[Details to be furnished with necessary work order signed from concerned project in-charge not below the rank of Executive Engineer or Competent Authority. The Work order/Testimonials will be verified, if required]

(B) Works for which Tenderers already completed:

Description of work	Place & State	Name & address of the customer	Estimated value of work in lakhs	Stipulated period of completion	Date when decision is expected	Remark if any
1	2	3	4	5	6	7

4.12 Certificate from Charted Account stating turnover for the last five years is also to be uploaded.

Sl.No	Year	Turn over amount	Remark
1	2020-21		
2	2021-22		
3	2022-23		
4	2023-24		
5	2024-25		

Litigation and Arbitral Issues:

4.13 Net pending litigations should not be more than 50% of bidder's net worth. As a supporting document of undertaking letter to be submitted by Bidder. It must be certified by Authorized Legal person / lawyer.

4.14 No consistent history of court/arbitral award decisions against the bidder for the last five years. As supporting document of under letter to be submitted by Bidder. It must be confirmed by Authorized Legal person/ lawyer.

5.Special Conditions

5.1.1 Establishment of Labor Camp is strictly prohibited in the premises of Indian Institute of Science Campus. Essential labor for round the clock work at site will be allowed with prior permission of Project Engineer cum Estate Officer.

5.1.2 Any damage to the existing service lines during execution of work shall be got rectified by the bidder at his own cost and risk.

5.1.3 Debris shall be disposed-off to an undisputed place of Bangalore outskirts as per the direction of the Engineer-in-Charge, whenever required.

5.1.4 Labor employed at the site will not be allowed to use cellphone while working at the site.

5.1.5 Supply of Electricity: - Electricity required for construction shall be arranged by the contractor himself. Electricity if supplied to the contractor by the Institute will be metered and amount will be recovered in the Bills as per actual at rates fixed by the Institute. Supply of electricity from the Institute is not mandatory. Non-supply of electricity by the Institute cannot be held as reason for shortfall in progress.

5.1.6 Water supply: The Contractor has to make his own arrangement for water supply. However, if water supply to the site at one convenient point is made available by the Institute, the charges for the consumption of water will be borne by the Contractor at 1.5 % of the value of the work.

5.2 Schedule of Quantities (Bill of Quantities) is attached herewith. It should, however, be clearly understood that these quantities are liable to alterations by omission, addition or variation, at the discretion of the Architects/Project Engineer Cum Estate Officer.

5.3 The drawings together with specifications and conditions of contract are enclosed. These should be studied carefully by the intending tenderers. In the absence of specifications for any item of work, material or ingredient in the specifications, CPWD/MoRTH specifications shall be followed and in the absence of specification for any item, materials are ingredient shall be fixed in all respects in accordance with the instructions and requirements of the Project Engineer Cum Estate Officer, the work will be the best of the kind.

5.4 The tenderer is expected to inspect the site and acquaint himself with the local conditions and will be deemed to have so done before submitting the tender.

5.5 The rates quoted shall be for finished work and shall include for all necessary incidental work. Sales or any other tax on materials in respect of this contract will be payable by the Contractor. The Contractors cannot presume any details regarding the contract.

5.6 It is entirely the responsibility of the Contractor to arrange for and provide all materials required for successful completion of the work except such special materials that may be supplied if any.

5.7 Tenders determined to be substantially responsive will be checked by IISc for any arithmetic errors. Errors will be corrected by the IISc as follows.

5.8 Where there is discrepancy between the rates in figures and in words, the lower of the two will be governed.

5.9 Where there is a discrepancy between the unit rate and the line-item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will be governed.

5.10 Where there is a discrepancy in entries of unit rate between the Original and Duplicate, the lower will govern.

5.11 The Contractor should make his own arrangements to cover the all-round construction area, by providing polyester net/polythene sheet/barricading to avoid inconvenience to other surrounding departments, as directed by the Project Engineer-cum-Estate Officer of the work.

5.12 The debris arise during the period of construction will have to be cleared then and there to keep the surroundings clean and tidy. Such debris shall, if not cleared, be cleared at contractor's risk and cost.

5.13 The contractor shall vacate the campus premises with all his men/ materials immediately after completion of the project.

6.GENERAL CONDITIONS

6.1 **DEFINITIONS OF TERMS**

In constituting these conditions and specifications, the following expressions shall have the meaning, therein assigned to them unless there is something repugnant in the subject of context in consisting with such meanings.

6.2 Institute shall mean the "Indian Institute of Science, Bangalore".

6.3 "Office" shall refer to the Office of the Project Engineer cum Estate officer.

6.4 "Contractors" shall mean the tenderer whether a firm, registered company, partnership or any individual whose tender has been accepted by Institute or by an Officer (duly authorized in this behalf) on behalf of the Institute and who has entered into agreement with Institute for due fulfillment of the contract and shall include the legal representatives, successors, heirs and assignees of the tenderer.

6.5 "Engineer" shall mean the "Project Engineer cum Estate officer", Indian Institute of Science, Bangalore or such other officer as may be appointed to call as the Project Engineer cum Estate officer for the purpose of the contract and shall also mean and include other officers of equivalent rank directly in charge of the work or any part thereof under administrative control of the Director, IISc, Bangalore-12.

6.6 When the Engineer is named as final authority, it includes all the above-mentioned officers and, in such matters, the contractors shall have the right of appeal against the orders up to the Director, IISc, Bangalore, whose decision shall be final and legally binding on all the parties concerned.

6.7 The Project Engineer cum Estate officer named as final authority for any decision taken, shall mean only the Director, IISc, Bangalore or his duly authorized assistant.

6.8 The Engineer in charge shall mean the Project Engineer cum Estate officer directly in charge of the work or his duly authorized assistants.

6.9 Plant shall mean and include any or all plants, machinery, tools and other implements of all description necessary for the execution of the work in a safe and workmen like manner.

6.10 The expression "Works" where used in these conditions shall unless thereby something in the subject or contract repayment to such construction, be construed to mean the work or the works constructed to be executed under or virtue of the contract whether temporary or permanent and whether original, altered, substituted or additional.

6.11 "Contract and contract document" shall mean and include the notice inviting tenders, proceedings of the pre bid meeting, the stamped agreement, conditions of contract, specifications and Schedules 'B', drawings and all other connected documents with tender schedule.

6.12 "Specifications" shall mean the specifications annexed and where these are not specifically mentioned shall be as may be detailed and necessary due to particular nature of work as approved by the Project Engineer cum Estate officer.

6.13 "Site" shall mean and include all the area in which operations in respect of the work are

carried out. This shall also include materials stacking yards and the area where temporary structures are put up for installing any machinery etc.

6.14 "Tests" shall mean such tests as are required to be carried out either by the contractor or by the Project Engineer cum Estate officer from time to time on completion as detailed in the specifications before the work is certified as being satisfactory and is taken over by the Project Engineer cum Estate officer.

6.15 "Month" shall mean a Calendar month.

6.16 "Prime contractor" means a firm that performs construction work itself and that the work is directly entrusted to the firm by the owner / Government / local body / Quasi Government / Government undertaking. Words used in singular shall also include the plural & vice-versa where the context so demands.

6.17 **CONTRACTOR TO INSPECT SITE**:

The contractor shall visit and examine the construction site and satisfy himself as to the nature of the existing roads or other means of communications, the character of the soil for the excavations, the extent and magnitude of the work and facilities for obtaining materials and shall obtain generally his own information on all matters affecting the execution of the work. No extra for charges made in consequence of any misunderstanding or incorrect information on any of these points or on the grounds of insufficient description will be allowed. All expenses incurred by the contractor in connection with obtaining information for submitting this tender including his visits to the site or efforts in compiling the tender shall be borne by the Tenderer and no claims for reimbursement thereof shall be entertained. .

6.18 ACCESS TO SITE:

The Contractor is to include in his rates for forming access to the site, with all temporary roads and gangways required for the works.

6.19 SETTING OUT:

The Contractor shall set out the building in accordance with the plans. All grid/center lines shall be pegged out to the satisfaction of the Engineer. The Contractor shall be responsible for the correctness of the lining out and any inaccuracies are to be rectified at his own expense. He will be responsible for taking ground levels of the site before setting out and recording them without any extra charge.

The Contractor shall construct and maintain proper benchmark at the intersection of all main walls, columns, etc., in order that the lines and levels may be accurately checked at all times.

6.20 **TREASURE TROVE**:

Should any treasure, fossils, minerals, or works of art of antique interest be found during excavation or while carrying out the works, the Contractor shall give immediate notice to the Engineer of any such discovery and shall make over such finds to the Institute.

6.21 **ACCESS FOR INSPECTION:**

The Contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, with ladders, gangways etc., and the necessary attendants to move and adapt as directed for the inspection of measurement of the works by the Engineer or their representatives.

6.22 **ATTENDANCE UPON ALL TRADERS:**

The Contractor shall be required to permit tradesmen/ Specialized agencies appointed by the employer to execute works like water supply, Sanitary, Electrical installation, lifts, air conditioning, hardware and other specialized works. The contractor shall also permit the above mentioned agencies to use his scaffolding and retain the scaffolding till such works are completed. The rates quoted by the contractor shall be inclusive of the above facility.

6.23 **GATEKEEPER AND WATCHMAN:**

The Contractor from the time of being placed in possession of the site must make arrangements for watching, lighting and protecting the work, all materials, workmen and the public by round the clock on all days including Sundays and holidays at his own risk and cost.

6.24 **STORAGE OF MATERIALS:**

The Contractor shall provide for necessary sheds of adequate dimension for storage and protection of materials like cement, steel, lime, timber and such other materials including tools and equipment which are likely to deteriorate by the action of sun, wind, rain or other natural causes due to exposure in the open. The cement storage site shall be leak proof and shall hold at least 4 months requirement. All such sheds shall be cleared away and the whole area left in good order on completion of the contract to the satisfaction of the Engineer.

All materials which are stored on the site such as bricks, aggregates etc., shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials.

6.25 **COST OF TRANSPORTING**:

The Contractor shall allow in his cost for all transporting, unloading, stacking and storing of supplies of goods and materials for this work on the site and in the places approved from time to time by the Engineer. The Contractor shall allow in his price for transport of all materials controlled or otherwise to the site.

6.26 **W.C. AND SANITARY ACCOMMODATION AND OFFICE ACCESSORIES AND ACCOMMODATION**:

The contractor shall provide at his own cost and expense adequate closet and sanitary accommodation complying in every respect to the rules and regulations in force of the local authorities and other public bodies, for his workmen, for the workmen of nominated sub-contractors and other contractors / specified agencies working in the building, the Project Engineer of works and other Institute agents connected with this building project and maintain the same in good working order.

The Contractor shall also provide at his own expense adequate office accommodation for the Project Engineer of works preferably contiguous to his office and shall maintain the same in a satisfactory condition and shall provide light, fan and attendant etc., for the same and shall remove them after completion of the works. He shall arrange to provide latest survey Instruments andat all times maintain the same in good working order at site, to enable the Project Engineer of works or other representative of Institute to check the lines and levels of the work.

6.27 **MATERIALS**:

Materials shall be of approved quality and the best of their kind available and shall conform to I.S. specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work-involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Project Engineer.

6.28 **TO ASCERTAIN FROM CONTRACTORS FOR THE OTHER TRADES.**

The Contractor shall ascertain from all agencies / Sub-contractors all particulars relating to their work with regard to the order of its execution and the position in which chases, holes and similar items will be required; before the work is taken in hand as no patch works shall be allowed for cutting away work already executed in consequence of any neglect to ascertain these particulars beforehand.

6.29 **SAMPLE APPROVAL:**

Before ordering materials, the Contractor shall get the samples approved from the Project Engineer cum estate officer well in time.

6.30 **TESTING OF WORK AND MATERIAL**:

The Contractor shall, if required by the Engineer arrange to test materials and/or portions of the works at his own cost in order to prove their soundness and efficiency. If after any such test the work or portion of works is found in the opinion of the Engineer to be defective or unsound, the Contractor shall pull down and redo the same at his own cost. Defective materials shall immediately be removed from the site at his own cost.

6.31 **FOREMAN AND TRADESMEN:**

All Tradesmen shall be experienced men properly equipped with suitable tools for carrying out the work of carpentry and joinery and other specialist trades in a first-class manner and where the Engineer deem necessary, the Contractor shall provide such tools which are considered necessary for carrying out of the work in a proper manner.

All such tradesmen shall work under an experienced and properly trained Foreman, who shall be capable of reading and understanding all drawings, pertaining to this work and the contractor shall also comply with other conditions set out in different clauses of the conditions of the contract.

6.32 **PROJECTPROGRAMME OF WORKS AND WEEKLY PROGRESS REPORT**:

a) Organization chart:

The contractor should submit the proposed organization chart for the project including the details of staff to be deployed full time on site to the approval of Project Engineer, where the PROJECT ENGINEER raises any objection to either the qualification or experience or required professionalism of any of the staff deployed by the contractor, the same shall be replaced by suitably competent person to the approval of PROJECT ENGINEER within 7 days.

b) Program chart:

The Contractor shall furnish the detailed programme of execution for timely completion of the project (inclusive of rainy season). Such a detailed program of works prepared using Industry Standard Scheduling Software like MS Project 2000 or Primavera shall be submitted by the Contractor within ten days after receiving communication of tender acceptance. As per the detailed drawings and schedule of quantities; the contractor shall work out concurrent activities with start and finish times, integrating of all tasks with interface and milestone event drawn and to evaluate for reduction in total project duration through improved over lapping of tasks and activities where feasible. The Contractor shall plan for improved planning and scheduling of activities and forecasting of resource requirements, ability to use the computer effectively to produce timely valid information for Project Management purpose. Accordingly, PERT; CPM Networking shall be drawn. GANNT charts shall also be furnished. The Contractor shall also furnish necessary particulars to the Project Engineer of works for compiling weekly progress reports in the form furnished by the Institute. A monthly financial programme shall also be submitted.

6.33 **CLEARING OF SITE**:

The contractor shall after completion of the work clear the site of all debris and left-over materials at his own expense to the entire satisfaction of the Institute. The same should be carted out of the Institute at his own cost.

The contractor shall also clear the labour camp/RMC plant of all types of permanent/temporary structures, soak pits, sump, septic tanks or any other such installations as identified by the PROJECT ENGINEER to the entire satisfaction of the Institute. The debris/excess stuff shall be carted out of the Institute at his own risk and cost.

6.34 **PHOTOGRAPHS**:

The Contractor shall at his own expense supply to the Institute photographs in duplicate copies not less than 25 cm x 20 cm. (10" x 8") along with soft copy, of the works taken from all the portions of the building at intervals of not more than one week during the progress of the work, or at every important stage of construction, as directed by the Project Engineer of work.

6.35 **PROVISION OF NOTICE BOARD**:

The Contractor shall provide a notice board on proper supports 3m x 2m (10' x 6') in a position approved by the Engineer. He shall allow for painting and lettering stating name of work; name of Architects; Structural Consultants; General Contractor and Sub-Contractors. All letters except that of the name of the work shall be in letters not exceeding 5 cm. in height and all to the approval of the Engineer. Proper barricading shall be erected all-round the site before commencement of the work.

6.36 **PROTECTION:**

The contractor shall properly cover up and protect all work throughout the duration of work until completion, particularly masonry, moldings, steps, terrazzo or floor finishes, staircases and balustrades, doors and window frames, plaster angles corners lighting and sanitary fittings, glass, paint work and all finishing.

6.37 **PREPARATION OF BUILDING FOR OCCUPATION AND USE ON COMPLETION:**

The whole of the work shall be thoroughly inspected by the Contractors and all deficiencies and defects set right. On completion of such inspection, the Contractor shall inform the Engineer in writing that he has finished the work and it is ready for the Engineer's inspection.

On completion, the Contractor shall clean all windows and doors and all glass panes, including cleaning of all floors, staircases and every part of the building including oiling of all hardware. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Engineer.

6.38 The tenderer must understand clearly that the rates quoted are for complete items of works including charges due to materials, labour, all lead and lift, HOM of plant and machineries, scaffolding, supervision, service works, power, all types of royalties, sales tax, labor cess, all types of taxes payable to the Govt and local bodies, overhead charges, etc., and includes all extra to cover the cost of night work if and when required and no claim for additional payment beyond the prices or rates quoted will be entertained for payment subsequently towards any claims on the grounds of misrepresentation or on point that he was supplied with information given by promise or guarantee by the Institute, or by any person whether member of or employee in Institute will not be entertained. Failure on the contractor's part to obtain all necessary information for the purpose of submitting his tender and quoting rates therein shall not absolve him of any risk or liability consequent upon the submission for tender.

6.39 All the works shall be carried out as per specifications prescribed by BIS, National Building code, CPWD / KPWD specifications, relevant IS codes or as directed by the Project Engineer in the absence thereof.

6.40 In case there is any conflict in the specifications and drawings the decision of the Project Engineer cum Estate officer shall be final and binding on the contractor.

6.41 All the materials shall be got approved by the Project Engineer cum Estate officer before use.

6.42 The rates quoted for in individual items shall include labour, cost of materials conveyance and lift charges for all materials required for successful completion of work and all taxes payable to any authority as per rules in vogue from time to time.

6.43 Necessary pillars shall be constructed by the Contractor for benchmark at no extra cost as directed by the Project Engineer.

6.44 Site order book shall be maintained in the work spot and the contractor shall sign in the order book in token of having gone through the instructions issued by the inspecting officers and carryout the instructions promptly.

6.45 In the work spot the contractor shall provide suitable temporary office with a covered area of 1000 sq.ft matching that of the Contractor's office with necessary furniture for use of Institute as directed by the Project Engineer for which no extra payment or compensation shall be claimed. The furniture however will after completion of the work, be the property of the contractor and shall remove them at the close of the contract.

6.46 The contractor shall take all precautions against damage from accident. No compensation will be allowed to the contractors for their tools and plant materials lost or damaged from any cause. The contractor is liable to make good the structure or plants damaged by any other cause at his own cost. The Institute will not pay the contractor for corrections or repairing any damaged portion of work done during construction.

6.47 The contractor shall employ adequate no. of skilled & unskilled labours required for successful timely execution of work. He shall submit daily reports to the Engineer in charge regarding the strength of labour employed both skilled and unskilled.

6.48 The contractor shall furnish weekly medical report showing number of persons ill or incapacitated and nature of their illness, to the Project Engineer.

6.49 The contractor shall furnish a report of any accident which may occur, within 24 hours of its occurrence to the Project Engineer.

6.50 The contractor shall keep on site of work a qualified Engineer as required as per rules of registration as their authorized representative who will receive all instructions given from the Institute officers. The representative shall have permanent office at site of work where communications can be sent and notices can be served by the Project Engineer throughout the duration of work.

6.51 Prior approval should be obtained from the Project Engineer for the construction and location of the temporary site office, store sheds and labour quarters, within the premises of the site, similarly the contractor shall get approval of the Project Engineer regarding the areas to be utilized for stacking the materials etc., for the work.

6.52 Reference to detailed specifications are indicated against the items contained in the Schedule 'B', in case there is any item for which no detailed specifications is indicated, it shall be carried out as per specifications intimated by the Project Engineer. The contractor shall not be entitled for any extra claims or compensation on this account. In case of additional or extra items not

covered by the Schedule 'B', the contractor shall carry out the work as per specifications intimated by the Project Engineer.

6.53 The Engineer shall have the right to direct the contractor to progress the various items of works in the manner prescribed by him.

6.54 Failure to adhere to any of the above will be sufficient cause for taking action under clause (2) or clause (3) or both along with their sub clauses of conditions of contract.

6.55 Contractor shall make arrangements at his own cost to construct approach road for conveyance of materials etc., preferably on the alignment accepted by the Institute to procure land etc. for housing, staff and workmen near the site of the work.

6.56 It is not possible for the Institute to release any quarry (metal and sand etc.,) for this work. The contractor has to make his own arrangements. No claim regarding leads and lift will be accepted.

6.57 The contractor has to make his own arrangements in regard to power supply and water required for construction and drinking water facilities.

6.58 Tool, Tax, Octroi, Royalty for collecting earth, gravel, sand, stone, excise duty, sales tax, labourcess or any other tax payable on account of this contract shall be met by Contractor.

6.59 The contractor shall be entirely responsible for sufficiency of the scaffolding, timbering, machinery, tools, implement and generally of all means used for fulfillment of the work. Whether such means may not be approved or recommended by the Project Engineer, the contractor must accept at his own cost all risks of accidents or damages.

6.60 After completion of the work, service drawings as per actual execution in Auto CAD should be submitted by the agency for services such as Electrical, Water supply and Sanitary before submission of final bill.

6.61 Extra care shall be taken regarding the laborers by providing waist belt, Helmets scaffolding etc. at your own cost and supervision and shall be carried out as per the directions of the Project Engineer.

6.62 WORKMANSHIP AND LABOUR:

The quality of all materials, tools, operators and labour used on the work shall be subject to the approval of the Project Engineer cum Estate officer or his authorized agent who shall have power to order immediate removal by the contractor any of the above that may not meet with his approval.

In case of failure to carry out orders of removal within the time specified, the Project Engineer or his authorized agents shall get the same removed at the contractor's expense.

6.63 KEEPING DRY AND PUMPING:

Unless otherwise provided for in the contract, the contractor will at his own expense keep all portions of the work free from undue water, whether due to springs, soakage or inclement weather and will use his own implements and machinery for this purpose.

6.64 BAILING OUT OR DEWATERING:

Adequate arrangements shall be made by the contractor for dewatering the foundation trenches and excavation and keeping the same dry while the masonry or concrete work is in progress and

till the Project Engineer considers that the mortar is sufficiently set.

The rates for the various items include the cost of shoring, strutting, coffer dam, channels or other incidental devices necessary for diverting the water met within foundation. The cofferdam and the diversion channel shall, however, be maintained in good and working condition till the completion of the structure or until such time, as in the opinion of the Project Engineer till the coffer dam or/and diversion channel is no longer necessary. Bailing out water necessitated by the failure to maintain the cofferdam and diversion channel will not be paid for separately under any conditions.

No extra rate shall be paid for removing any stuff outside, which might find excess due to rains or for reasons whatsoever from the sides or bottom of the foundation trenches and excavation or from also where when the dewatering operations are in progress.

The contractor must assure himself by making the necessary investigation regarding the depths to which foundations are likely to go. If any work is ordered to be done beyond dimensions or deviations marked in the drawings, no extra rate other than the rate for the Undertaking of work quoted by the contractor be paid.

The contractor will make himself arrangements for necessary plant such as Pump, engines, and other materials required in this connection.

6.65 FACILITIES FOR INSPECTION:

The work at all times be open for inspection by the Project Engineer or his duly authorized Assistant and the contractor shall arrange easy access to every part of the work and shall provide such ladders, scaffolding and lifts for this purpose as necessary at his own cost.

6.66 DELIVERY OF WORKS:

The final bill will be prepared after the work is handed over to the Project Engineer or his duly authorized representative in a thoroughly complete, clean, sound and workman like state.

6.67 EXTRA ITEM:

Whenever the contractor is ordered by the Project Engineer or the person duly authorized by him to execute any item of work, which is not in his tender, it shall be the contractors duty to see that the order is duly entered in the order book on the work, unless a separate communication to this effect is received by him, it shall be his duty to get the rates sanctioned for the item by the appropriate authority. For any extra item of work not thus ordered either by any entry in the order book or separate communication, the contractor shall have no claim to payment.

6.68 COMPLIANCE WITH BYELAWS AND PROTECTIONS AGAINST ACCIDENTS, ETC:

Contractor is responsible for complying with all acts, bye-laws, Municipal and other regulations for the provision and maintenance of lights during nights, barricading, providing any other protection that may be necessary and will be liable for all claims that may arise from accidents of nuisance caused by works.

6.69 DISPUTES:

Disputes on the points between the Project Engineer and the contractors shall be referred to the Center for campus management and Development, whose decision shall be given in writing and shall be final and binding on the contractor.

6.70 TOOLS ETC.,

The contractor shall unless otherwise specially stated in the contract, be responsible for the payment of all import duties, octroi duties, sales tax, quarry fees etc., on all materials and articles

brought to site.

6.71 CLEARANCE OF SITE:

The site described and shown on the plan is to be cleared of all obstruction, loose stones and materials, rubbish of all kinds of shrubs and brushwood, the roots being entirely removed. The products of the cleaning to be stacked in such a place and manner as ordered by the Project Engineer.

In jungle clearing all trees not marked for preservation, jungle wood and brushwood shall be cut down and their roots entirely removed up. All wood and materials from the clearings will be property of the Institute and should be stacked as the Engineer in charge directs. Trees shall not be cut without prior permission of the Institute.

All holes or hollow, whether originally existing or produced by digging up roots, shall be carefully filled up with earth well rammed to the required density and leveled off, as may be directed.

6.72 LINE OUT:

The contractor shall use necessary measuring instruments, theodolite, workstation and other materials like flags, strings, pegs, nails, pillars, paints, etc., and also Labour required for ascertaining of the initial ground levels at the different stages of excavation and construction of masonry or other structures at his own cost. Any dispute in regard to the accuracy of the measuring instruments and the device shall be subjected to the final decision of the Engineer-in charge of the work.

6.73 MACHINERY: All the machinery that will be employed on the work shall be approved, efficient and thoroughly, complying with the specifications of each machine or parts and shall have been manufactured by reputed and qualified firms. All the machinery employed on the work shall be open to inspection at all working hours, by the Project Engineer and any defect shall be rectified, repaired, replaced, renewed or remodeled so that its performance in the opinion of the Project Engineer is satisfactory. Any defective part of the machine, which requires replacement, shall be promptly replaced, failing which the Engineer-in-charge, shall be at liberty to cause the defective fittings removed from site of work at the cost of the contractor.

6.74 OPERATORS: The machines shall be in charge of efficient and trained operators, which terms shall include drivers, mechanics or other personnel who are actually operating the machines. The Engineer in-charge has the right to test operators, etc., as deemed necessary by him for the class of machinery, which he is to operate and shall drive out such of the operators who fail in the tests.

6.75 SAFETY PRECAUTION: All reasonable safety precautions for the safety of workers shall be taken. The contractors shall be responsible for the maintenance of all regulations under the Factory Act, workmen's compensation. Minimum wages act and other act for the safety and welfare of the workers employed by him. In addition, the contractors shall provide adequate protection to all workers employed by him against natural elements such as rain, sun, wind etc., during working hours and provide free, pure protected drinking water during working hours.

6.76 NON-STOP OPERATION:

In the continuous or non-stop operations suitable shifts or working hours for each shift shall be maintained. The contractor is liable for all reasonable extra payment for all extra hours of work done by the workers employed by him.

6.77 TESTS:

The Project Engineer cum Estate officer or his authorized representatives shall have full scope and right of entry at all times to examine and test, measure, count, weigh, take bores, or in any manner satisfy himself that the work executed is according to the specifications and required

strength. Any portion of work got disturbed, during such tests, shall be made good by the contractors, without extra cost. The Engineer in charge has the right to change the design proportions, mixes within reasonable limits to ensure requisite strength of the structure. Laboratory for requisite tests shall be established by the Contractor at site only, at his own cost.

6.78 ADEQUATE ARRANGEMENTS TO ACHIEVE PROGRESS:

The Project Engineer shall have the right to advise the contractor on the strength, quality and nature of labour to be employed on work to maintain progress on the work, commensurate with the strength of structure. Similarly, he shall advise the contractor on the nature and adequacy of the machinery that are required on the work.

6.79 DETAILS TO BE FURNISHED FOR ENGAGING SUB-CONTRACTOR FOR SPECIALISED WORKS:

The tenderer shall be required to engage agencies of standing and repute who have experience in executing works of similar nature and magnitude. Such specialized trades cover electrical installation (HT/LT), Lifts, A.C. sanitary and water supply works, firefighting installation and any such other trades as may be directed by the Institute. The successful tenderer shall be required to engage Sub-agencies for such specialized trades only with the prior written approval of the Project Engineer cum Estate officer after giving an opportunity to the Project Engineer cum Estate officer to evaluate the experience and competence of the sub-agency for each trade. In order to ensure implementation of this requirement, it is required that each tenderer shall submit along with his tender, names of three sub-agencies for each trade amongst whom tenderer proposes to engage if successful in the tender. Along with names of sub-agencies for each trade, the tenderer shall furnish in detail the following particulars in respect of each sub-agency.in the format furnished in Technical Bid.

All such information concerning sub-agencies shall be furnished along with the tender. Any tender containing insufficient information in this regard is liable for rejection. In the event of non-compliance of this requirement, the Institute shall have the right to nominate any sub-agency who in their opinion meets the selection criteria. In such event it would be incumbent on the successful tenderer, to accept and appoint then nominated sub-agency without demur and on this account, if there is any additional cost, such cost shall be borne by the successful tenderer. The Institute shall have no liability on this account. The Institute has the right to evaluate the experience, reputation etc., of such sub-agencies and on their approval in writing to the successful tenderer, successful tenderer shall be required to engage only such approved agencies for execution.

If the Institute is not satisfied with the performance or capability of the names in the panel furnished by the tenderer, the successful tenderer shall be required to engage an agency nominated by Institute. In all these matters, there shall be no additional financial implication to the Institute. The successful tenderer shall be required to execute works within the accepted rates only and no claim will be accepted due to the Institute, insistence on engaging any sub-agency. The Institute further reserves the right to instruct the successful tenderer to terminate the work of sub-agency at any time during the contract, if the performance is found unsatisfactory. In such case, the successful tenderer shall be required to furnish a further panel of names from whom a similar selection can be made by the Institute In this instance also, the Institute is not liable for any additional cost. Responsibility for the delay occurred in this process, if any shall rest with the successful tenderer.

It is the responsibility of the successful tenderer to ensure that the sub-agencies engaged in the work comply with all the clauses in the agreement between the Institute and the successful tender. It shall be responsibility of the successful tenderer to exercise first line supervision on the works executed by his subagencies including supervision on the quality of materials and

workmanship and to ensure that the subagencies comply with the technical specifications, drawings and bill of quantities. The successful tenderer shall also establish competent site organization technically and administratively to ensure that the works of various sub-agencies are supervised and well co-ordinate to ensure proper sequencing of construction and finishing works and to ensure that the overall time schedule is fully complied with.

The detailed construction programme schedule to be furnished by successful tenderer shall include action plan for procurement of materials and execution of works at site for each of the sub-agency and the detailed construction programme schedule shall reflect proper integration of each component of the building to ensure well-coordinated execution so as to complete the project including services within the stipulated time schedule.

6.80 Existing service lines such as electrical, water supply, sewer lines, telephone lines etc., shall be carefully protected and preserved before commencement and during excavation, dismantling /demolition operations. Details of UG facilities shall be provided to the successful tenderer. Any damage caused to the aforesaid service lines, etc., during excavation, demolition/dismantling shall be made good at Contractor's own expense/cost. Restoration of any service lines, which needs to be shifted and found in the proposed site, is the responsibility of the contractor and the agency shall carry out the work as per the direction of Project Engineer the cost of such work will be borne by the Institute.

6.81 Dust nuisance to neighbour shall be minimized by providing and erecting screens to the required height as per direction of Project Engineer cum Estate officer with Aluminium sheets or canvas or other suitable material before commencement of the work. The site shall be cleared off such protection arrangement after virtual completion of work. All the operations shall be carried out strictly in accordance to regulations of municipal and other local authorities and shall be restricted to normal working hours.

6.82 No debris or materials got from dismantlement/demolition the building(s) shall be thrown in the public road causing inconvenience to the traffic and any fine or penalty imposed by local authority for non-compliance of this provision shall be borne by the contractor.

6.83 The Contractor shall be responsible for any injury to persons, animals, or things and for all structural damage to property which may arise from the operation or neglect of himself and or any nominated sub-contractors, contractor's Employees and or third party whether such injury or damage arising from carelessness, accident or any other cause whatsoever, in any way connected with the carrying out the construction/dismantling/demolition.

The contractor shall take required insurance cover with an approved insurance company as provided in the contract and deposit with the Institute well before commencement of construction/ demolition / dismantling.

6.84 **Preservation of trees**: The contractor shall preserve all existing trees in and adjacent to
6.85 the site which does not interfere with the construction as determined by the Engineer-in charge.

6.86 **Drawings and working Details:** The work shall be carried out strictly in accordance with the approved plans and estimates and specifications and as per the instructions of the Engineer-in-charge, and no deviations or changes are permitted without the written order of the Engineer. The designs and drawings enclosed with the tender documents are only typical and tentative. The working drawings and the working details of the several components of works will be prepared and made available at the time of execution and the contractor shall carryout the work in accordance with such working drawings and working details.

6.87 **Omissions and discrepancies in drawings and instructions:**

In all cases of omissions, doubts or discrepancies in the dimensions or discrepancies in the drawings and item of work, a reference shall be made to the Project Engineer cum Estate

officer, whose elucidation and elaboration shall be considered as authorized. The Contractor shall be held responsible for any error that may occur in the work through lack of such reference and precautions.

6.88 The contractor shall be responsible for accuracy for all shapes, dimensions, and Alignments both vertical and horizontal etc., of all the components of the work.

6.89 **Lands for the use of the Contractors Camp:**
The contractor shall have to make his own arrangements at his own cost for construction of living accommodation outside the IISc premises. The Employee shall not provide any space / building for labour camp.

6.90 **Undesirable Person to be removed from site:**
The contractor shall not employ on site any person who is undesirable, if in the opinion of the Project Engineer the person or persons at site of work employed on behalf of the contractor is/are considered undesirable. The Project Engineer shall notify the contractor to this effect and the contractor will be bound by the decision of the Project Engineer to remove such person or persons from the site of work and from the labour camp. The contractor shall not be entitled to any damage or loss on this account. On the contrary, the contractor shall be liable to compensate the Institute for any loss or damage to the Institute property caused by the employment of such person.

6.91 **Labour Statistics**:
The contractor shall submit daily reports on the following:
(a) Total No. of labour employed in the working area.

6.92 **Execution of work during night times:**
The work shall normally be carried out between 08.00 hours and 17.00 hours with a break of one hour and when permitted during night period, the second shift shall be between 17.00 hours and 00 hours with a break of half an hour during night. When ordered to work at night, adequate provision for lighting the working area should be made by the contractor at his cost and got approved by Engineer. The agency shall not be paid extra for the works executed during night.

6.93 **Safety code:**

a) The Contractor at a prominent place at work spot should bring these safety provisions to the notice of all concerned by display on notice board. The persons responsible for compliance of the safety code shall be named therein by the contractor.
b) To ensure effective enforcement of the rules relating to safety precautions, the arrangement made by the contractor shall be open to inspection by the Labour Officer, Engineer or his representatives.
c) All necessary personal safety equipment's as considered adequate by the Engineer should be kept available for immediate use of persons employed at the site and maintained in the good condition and the contractor should take adequate steps to ensure proper use of equipment by those concerned.
d) Workers employed on mixing concrete, cement grout, cement mortar shall be provided with protective footwear protective goggles and protective gloves. Those engaged in mixing or stacking cement or any materials injurious to the eye, nose and mouth shall be provided with a face mask and protective cover free of cost by the contractor.
e) Those engaged in welding work shall be provided with welder's protective eye Shield and gloves. Stonebreakers shall be provided with protective goggle and protective

clothing and seated at sufficiently safe intervals.

f) Those engaged in binding and fabricating steel shall be provided with protective gloves.
g) Those engaged in deep cuts, large rock excavation shall be provided with helmets.
h) All labour / persons at work shall wear helmet compulsorily.
i) When the work is near any place where there is risk of drowning all necessary equipment's shall be kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions should be made for prompt first aid treatment of all injuries likely to be sustained during the course of work.
j) Adequate and suitable caution and danger signal boards shall be prominently exhibited at road/high tension overhead line/where heavy electrical machines are working where overhead cranes or hoist; derricks, winches are working where blasting zone is demarcated. The content of the board shall be in English and the local language for easy identification.
k) All scaffolding, ladder, stairways, gangways, staging, centering, form work and temporary support and safety devices etc., shall be sound in strength and constructed and maintained as such throughout its use. The agency shall obtain approval from Project Engineer cum Estate officer for scaffolding, formwork etc., before commencement of work.
l) No materials on any site of work shall be so stacked as to cause danger or inconvenience to any persons or public.
m) The Contractor shall provide all necessary fencing and lighting to protect the public/working men from accident and shall be bound to bear the expense of defense of every suit action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost, which may be awarded in any such suit action or proceedings to any such persons or which may with consent of the contractor be paid to compensate any claims by any such person.
n) No electric cables or apparatus, which is liable to be a source of danger to persons, employed shall remain electrically charged unless a caution Board is put into that effect and close approach to the same is prohibited.
o) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosives. No floor, roof or other portion of any building used for residence shall be so over-loaded with debris or materials so as to render it unsafe.
p) The final disposal of water used for work or removed from work spot as well as the supply used for domestic consumption shall be as directed by the Engineer. The contractor shall make his own arrangement for purification of domestic water supply used by his staff and labour colony and used on the site of work to the satisfaction of the Engineer.
q) The source of drinking water supply/distribution system in workers colony shall be protected from chances of contamination by poisonous materials epidemic causing infections bacteria etc., by maintaining the source and system under adequate hygienic conditions.
r) Notwithstanding the above clauses, there is nothing in this to exempt the contractor to exclude the operations of any other Act or Rules in force of the Central Govt., State Govt.

6.94 **AWARENESS OF SITE CONDITIONS AND CARRYING OUT OF SITE INSPECTION PRIOR TO TENDERSUBMISSION:**

Prior to the preparation and submission of his Tender, the Contractor shall make visits to the site and carry out all the necessary inspections and investigations in order to obtain all information and to make his own assessment of the conditions and constraints at site, including the means of access to it. The Contractor shall make himself aware of all the features

of the site and the working conditions and space and shall, in general, be responsible for obtaining all the necessary and requisite information needed for him to prepare and submit his Tender.
Should the Contractor require any clarifications he shall seek these in writing from the Project Engineer before submitting his Tender. At no stage will any extra claims be entertained or allowed on any matter or for any reason arising from or as a consequence of the Contractor's failure to comply with all the requirements stipulated in this Clause.

6.95 **WORK AND WORKMANSHIP**

To determine the acceptable standard of workmanship, the Project Engineer may order the Contractor to execute certain portions of works and services under the close supervision of the Project Engineer. On approval, they shall label these items as guiding samples so that further works are executed to conform to these samples.

6.96 **TEST CERTIFICATES**

The contractor shall submit copy of test certificates for all the major electrical equipment such as circuit breakers, CTs, PTs, instruments, relays, busducts, rising mains, busbars, cables etc., and panel as a whole, confirming to relevant IS/BIS standards issued by manufacturers.

6.97 **SAMPLES AND CATALOGUES**

Before ordering the material necessary for these installations, the contractor shall submit to the Engineer-in-Charge/Consultants for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc., along with the catalogues with their dimensional details.
For major items such as sub lighting panels distribution boards, the submission of drawings/catalogues along with technical details shall be enough. Prior to ordering any electrical equipment/material/system, the contractor shall submit to the Engineer-in-Charge/Consultants the catalogues, along with the samples, where applicable, from the approved manufacturer. The contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the Engineer-in-Charge/Consultant.

Also, the contractor shall ensure that the dimensional details of the equipment fit into the allotted space provided in the building.

6.98 **COMPLETION CERTIFICATE**

On completion of the electrical installation a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out.

6.99 **PERFORMANCE GUARANTEE**

The contractor shall indemnify the Institute against defective materials and workmanship for a period of one year after completion of the work. The contractor shall also hold himself fully responsible during that period for reinstallation or replacement at free of cost to institute, the following:
Any defective work or material supplied by the Contractor.

Any material or equipment damaged or destroyed as a result of defective workmanship by the

contractor.

6.100 **RATE ANALYSIS**

At anytime and at the request of the Project Engineer the contractor shall provide details or breakdown of costs and prices of any part or parts of the works.

6.101 The Project Engineer cum estate officer of IISc reserves the rights to delete any item from the contractor's scope of work.

7.CONTRACTOR'S LABOUR REGULATIONS

7.1 DEFINITION:

In these regulations unless otherwise, expressed or indicated the following words and expressions shall have the meaning hereby assigned respectively that is to say:

Labour means workers employed by the contractor or the Institute directly or indirectly through sub-contractor or any other person, or any agent on his behalf on a payment as per prevailing Karnataka State labour regulations and will not include supervisory staff like overseers etc.

Fair wages means whether for item or place of work notified at the time of inviting tenders for the work and where such wages have not been so notified, the wages prescribed by the Karnataka Public Works Department for the district in which the work is done.

Contractors shall include every person whether a sub-contractor head or agent employing labour on the work taken contract.

The relevant orders of Government of Karnataka in regard to payment of wages as amended from time to time shall be followed by the contractor.

7.2 WORKING HOURS:

Normally working hours of a labour employed should not exceed 8 hours a day. The working day shall be so arranged that inclusive of interval for rest if any, it shall not spread over more than 12 hours on any day.

When a worker is made to work for more than 8 hours on a day or for more than 48 hours in any week, he is entitled to double the ordinary rate of wages. Children shall not be made to work.

Every worker shall be given a paid weekly holiday normally on Sunday.

7.3 DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall (a) before he commences his work on contract, display and correctly maintain in a clean legible condition in conspicuous places on the work, notices in English and in the local language spoken by the majority of the workers, giving the rate of wages which have been certified by the Regional Labour Commissioner, as fair wages and the hours of work which such wages are earned, and a copy of such notices shall be sent to the certifying officers.

7.4 PAYMENT OF WAGES:

Wages due to every worker shall be paid to him direct.

7.5 FIXATION OF WAGES PERIODS:

The contractor shall fix the wages period of which the wages shall be payable.
Wages of every worker employed on the contract shall be paid.

In case of establishments in which the wage period is one week, within three days from the end of the wage period wages shall be paid. In the case of other establishment before the expiry of the 7th day or 10th day from the end of the wage period according to the numbers of the workers employed in such establishment does not exceed 100 or exceeds 1000.

When the employment of any workers is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the days succeeding the one which his employment is terminated.

All payment of wages shall be made on a working day except when the work is completed before the expiry of the wages period in which case final payment shall be made within 48 hours of the last working day at work site and during the time.

NOTE: The term working day means a day on which the labour is employed, and the work is in progress.

7.6 FINE AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES:

The Wages of workers shall be paid to him without any deductions of any kind except the following deductions:
Deductions for absence for duty i.e., from the place or the places whereby the terms of his employment he is required to work. The amount of deductions shall be in proportion to the period for which he was absent.

Deductions for damage or loss of goods expressly entrusted to the employed person for custody or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to neglect or default.

Deduction for recovery of advance or for adjustment of over payment of wages, advance granted shall be entered in a register.

And other deductions which the Institute may from time to time allow.

7.7 Fine:

No fine shall be imposed on any worker save in respect of such acts and the Commissioner of Labour has approved omissions on his part as.

No fine shall be imposed on a worker and no deduction for damage or loss be made from his wages until the worker has been given an opportunity. Undertaking of showing cause against such fines or deductions.

The total amount of fines which may be imposed in any one wage period on a worker shall not exceed an amount equal to the wages payable to him in respect of that wage period.

No fine imposed on any worker shall be recovered from him by instalments or after the expiry of sixty days from the date which it was imposed.

Every fine shall be deemed to have imposed on a day of the act or omission in respect of which it was imposed.

The contractor shall issue an employment card in Form III to each worker on the day of the worker's entry into the employment. If the worker has already any such card with him for the previous employment of contractor, he shall merely endorse that employment card with relevant entries. On termination of employment, the employment card shall again be endorsed by the contractor and returned to the worker.

7.8 REGISTER OF UNPAID WAGES:

The contractor should maintain a register of unpaid wages in such a form as may be convenient at the place of work but same shall include the following particulars:

- Full particulars of the labourer's whose wages have not been paid.
- Reference number of the muster roll and wage register
- Rate of wages
- The period
- Total amount not paid
- Reasons for not making payment

- How the amount of unpaid wages was utilized
- Acquaintance with dates.

7.9 REGISTER OF ACCIDENTS:

The contractor shall maintain a register of accidents in such form as may be convenient at the workplace but the same shall include the following particulars.

- Full particulars of the laborers who met with accidents.
- Rate of wages
- Sex
- Age
- Nature of accidents and cause of accident
- Time and date of accidents
- Date and time when admitted in Hospital
- Date of discharge from the Hospital.

The agency shall alone be liable to pay compensation for any damage/death /injury sustained by the personnel or any other members of the agency in the course of their work/duty at the Institute during the contract period. Govt. of India issued guidelines on payment of compensation in cases of death / permanent incapacitation of person due to unintended/ unforeseen occurrences during maintenance, operation and provisioning of public services. Under these guidelines, the agency has to pay an amount of Rs. 10 Lakhs as compensation in the cases where a person is died and up to Rs. 7.5 Lakhs in the case of disabled based on loss of earning capacity. Institute has the right to recover further penalty in the cases where the incidents have happened with the negligence of the agency.

7.10 REGISTER OF FINE ETC.

The contractor shall maintain a register of fines and a register of deductions for damages or loss in form Nos. I and II respectively which shall be kept at the place of work.

The contractor shall maintain both in English and local language a list approved by Commissioner for labour clearly stating the acts and commissions for which penalty or fine may be imposed on a workman and display it in a good condition in conspicuous place on the work.

7.11 SUBMISSION OF RETURNS:

The contractor shall submit periodical returns as may be specified from time to time.

7.12 AMENDMENTS:

The Government of Karnataka may from time to time add to or amend the regulations and on may question as to the application interpretation on effect if these regulations the decision of the Commissioner of Labour or Deputy Commissioner for Labour to Govt. in that behalf shall be final.

7.13 Labour Clause

No labourers below the age of 18 years shall be employed on the work.

Payments of wages of labourers. The contractor shall pay not less than fair wage of labourers engaged by him on the work.

EXPLANATION:

(a)The contractor shall notwithstanding the provision of any contract to the contrary cause to be paid wages to labourers indirectly engaged for the work including any labour engaged by his sub-contractors in connection with the same works if the labourers have been immediately employed by him.

(b)In respect of all labours directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with

Govt. of India, Contractors Labour Regulations from time to time, in regard to payment of wages. Wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage book, wage slips, publication of scale of wage and other terms of employment, inspection and submission of periodical returns and all other matter of a like nature.
The Project Engineer cum Estate officer or In-charge Engineer concerned shall have the right to deduct from the money due to the contractors any sum required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or her wages which are not justified by their terms of the contractor non-observance of the regulations.
(c) For payment of minimum wages, the Contractor is bound to follow the relevant orders of Govt. of India from time to time.
(d)Vis-à-vis the Institute the contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors. The regulations aforesaid shall be deemed to be part of this contract, and any breach there of shall be deemed to be a breach of this.

7.14 In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this agreements the contractor shall at his own expense arrange for the safety provisions as per Karnataka P.W.D. safety code framed from time to time and shall at his own expense provide for all facilities in arrangements and provide necessary facilities as aforesaid he shall be liable to pay penalty of Rs.50/- for each default and in addition the Project Engineer cum Estate officer in charge shall be at liberty to make arrangements and provide facilities as aforesaid, and recover the cost incurred in that behalf from the contractor.

7.15 The contractor shall submit by the 4th and 19th of every month to the Project Engineer of true statement showing in respect of the second half of the preceding month and the first half of the current month respectively (1) the name of labourers employed by him on the work (2) their working hours, (3) the wages paid to them, (4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused to them and (5) the number of female workers who have been allowed, maternity benefit according to clause 19F and the amount paid to them, failing which the contractor shall be liable to pay the Institute a sum of not exceeding Rs. 50/- for each default or materially incorrect statement by deduction from any bill due to the contractor and amount levied as fine.

7.16 In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all the rules framed by Institute from time to time for the protection of health and sanitary arrangements for workers employed by the Indian Institute of Science and its contractors.
7.17 Maternity benefit rules for female workers employed by contractor, leave and pay during leave shall be regulated as follows:

(i) in case of delivery: Leave during maternity leave not exceeding 8 weeks up to and including the day of delivery and 4 weeks following that day.

(ii)In case of miscarriage, up to 3 weeks from the date of miscarriage.

7.18 Pay:

i)In case of delivery: Leave pay during maternity leave will be at the rate of women's average daily earning calculated on the total wages earned on the days when full time work was done during the period of three months immediately preceding the date on which she gives notice that she expects to be confined.
ii)In case of miscarriages: Leave pay at the rate of average daily earnings calculated on the total wages earned on the day's full time works was due during a period of 3 months immediately preceding the date of miscarriage.

iii) Conditions for the grant of maternity leave: No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than 10 Months immediately preceding the date of delivery /miscarriage.

8.CONDITIONS OF CONTRACT

Clause 1. <u>Security Deposit</u>

Estimated cost of the work put to tender	E.M.D Percentage	S.D. Percentage
(i)	(ii)	(iii)
Rs.12,61,08,627/-	**1%**	**6.5%**
Note : EMD + SD to be limited to 7.5% of the contract value		

(a) Clause -1(a) The person/persons whose tender may be accepted (hereinafter called the contractor which expression shall unless the context otherwise requires, include his heirs, executors, administrators and assigns) shall pay Earnest Money Deposit indicated in Column (ii) of the table given below and shall permit Institute (a) to deduct SD at the percentage mentioned in Column (iii) of the table given below of all moneys payable of work done under the Contract, at the time of making such payments to him/them and (b) to hold such deductions as further Security Deposit. The EMD + SD will be limited to 7.5% of the contract value.

E.M.D - Earnest Money Deposit
S.D-Security Deposit

No Interest will be paid on EMD / Further / Additional Security deposit.

(b) Additional or Reduction in Security Deposit

The EMD for the tendered work and additional amount of Security Deposit at the rates mentioned in **Sub-clause 1(a)** above should be, paid by the contractor. The Project Engineer cum Estate officer may allow if a portion of the work is withdrawn from the Contractor under the provisions of Clause 12(a) a proportionate reduction in the amount of security Deposit.

a) ***EMD paid along with the tender shall be refunded only after the completion of the defect liability period or payment of final bill whichever is later without any interest.***

b) ***1% labour cess towards workers Welfare Fund on the works expenditure will be recovered from RA bills for depositing the same to the welfare board as per Karnataka Govt. Order. Rates quoted should be inclusive of cess.***

(c) However, if the Contractor desires, agency may furnish a BG issued by the Public Sector Undertaking Bank/ Scheduled commercial Bank/Nationalized Bank in favour of the Registrar, Indian Institute of Science, payable at Bangalore amounting to **5.5%** of the total contract value valid upto completion of defect liability period in which case EMD deposited by them will be refunded and no recoveries towards security deposit will be effected in the running account bills.

(d) Dues to Institute, to be setoff against Security Deposit.

All compensation or other sums of money payable by the Contractor to Institute under the terms of this contract may be realized or deducted from any Security Deposit payable to him or from any sums which may be due or may become due by Institute to the Contractor on any account whatsoever and in the event of his security deposit being reduced by reason of any such realization or deduction as aforesaid, the Contractor shall, within ten days thereafter, make good in cash any sum or sums which have been deducted from his security deposit or any part thereof. Otherwise, the amount will be treated as outstanding due from the agency.

(e) Refund of Security Deposit (EMD &SD):

i) EMD paid by the contractor at the time of tendering and SD deducted from the R.A bills at the prescribed rates shall be refunded to the contractor immediately after the virtual completion of the work against production of bank guarantee for an equal amount from any of the Scheduled commercial Bank/Nationalized Bank valid for a period as mentioned in clause(ii)below.

ii) The bank guarantee received as stipulated in (i)above, will be treated as performance guarantee and shall be returned to the contractor after the final bill is paid or after **Twenty Four Months including monsoon period** from the date of virtual completion of the work during which period the work should be maintained by the contractor in good order, which ever is later. The validity of the bank guarantee shall be maintained for the above period.

iii) In case of BG's furnished towards security deposit same shall be returned after completion of the defect liability period.

Clause 2. <u>PENALTY FOR DELAY</u>

a) Written Order to Commence Work

After acceptance of the tender, the Project Engineer cum Estate officer shall issue a written order to the successful Tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of the Project Engineer cum Estate officer. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

b) Programme of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed by the contractor during execution of agreement.

c) Review of progress and responsibility for delay etc.,

The Project Engineer cum Estate officer shall review the progress of all works with the contractor at least once every month. Such a review shall take into account the programme fixed for the previous week, obligations on the part of the Institute for issue of drawings etc, and also the obligations on the part of the Contractor. The review shall also examine the accumulated delays by the contractor if any and mitigation measures proposed by the contractor to overcome the delay.

Apportioning of responsibility for delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by the Project Engineer cum Estate officer and the Contractor. If the contractor refuses to sign the said record, approval of the reasons

for delay may be submitted to **CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD)** for approval and such approval is binding on the contractor.

Shortfall in progress made up subsequently.

To the extent the shortfall is assessed, as due to the delay on the part of the contractor, a notice shall be issued to him by the Project Engineer cum Estate officer to make up the shortfall. If the shortfall is not made up before the progress of the work is reviewed during the second month succeeding the month in which the shortfall was observed, the Contractor shall be liable to pay penalty as indicated in **Clause 2(d)** below.

Grant of extension of time.

If the delay is attributable to reasons beyond the control of the Contractor, requisite extension of time shall be granted by the Project Engineer cum Estate officer in accordance with **Clause 5** after obtaining the approval of his higher authorities, wherever necessary.

Review of progress by Centre for Campus Management and Development.

The Centre for Campus Management and Development shall review the progress periodically, preferably more number of times as required. These reviews are in addition to the monthly reviews required to be done by the Project Engineer cum Estate officer. The results of such review by the CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD) shall, wherever necessary, be incorporated in the next review of the Project Engineer cum Estate officer.

If the Contractor stops the work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer, then The Employer may terminate the Contract at the risk and cost of the contractor.

Settlement of dispute regarding shortfall in progress.

In case of dispute between the Project Engineer cum Estate officer and Contractor regarding the responsibility for the shortfall in progress, the matter shall be referred to the Centre for Campus Management and Development who shall thereupon give a decision within fifteen days from the date of receipt of reference. The decision of the Centre for campus management and Development shall be final and binding on the contractor and the Project Engineer cum Estate officer.

d) Penalty for delay

In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per **Clause 2(b)** and **2 (c)**, the contractor shall be liable to pay as penalty an amount equal to one percent of the contract value of the balance work assessed according to the programme(Clause 35), for every week that the due quantity of work remains incomplete; provided always that the total amount of penalty to be paid under the provisions of this clause subjected to a maximum of 10 percent of the contract value of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.

Note: If the Project Engineer cum Estate officer considers it necessary, he shall be entitled to take action as indicated in **Clause 3 (d)** also.

d.(1). Liquidated damages

The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

(e) Adjustment of excess/over payments.

Excess/over payments as soon as they are discovered should be adjusted in the next running account bill of the contractor and in case the final bill has already been paid, the excess/over payment made shall be recovered from the Security Deposit of the contractor together with interest at such percentages as Institute may decide from time to time, from the date of such excess or over payment to the date of recovery.

ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

Clause 3. In any case in which under any clause or clauses of this contract the contractor shall have rendered himself liable to pay compensation and/or penalty amounting to the whole of his security deposit including the amount deducted in instalment from his bills as Further Security Deposit, the Project Engineer cum Estate officer on behalf of the Director, IISc shall have power to adopt any of the following courses as he may deem best suited in the interest of Institute.

(a) Forfeiture of Security Deposit.

Without prejudice to Institute's right to recover any loss from the Contractor under sub-clauses (b) and (c) of Clause 3 of the Contract, to rescind the contract (of which rescission notice in writing to the contractor under the hand of the Project Engineer cum Estate officer shall be conclusive evidence). And in that case, the security deposit of the contractor including whole or part of the lump sum deposited by him and also the amount deducted from his bills as Further Security Deposit, shall stand forfeited and be absolutely at the disposal of the Institute.

(b) Debiting cost of labour and materials supplied.

To employ labour paid by the Institute and to supply materials to carry out the work or any part of the work, debiting the contractor with the cost of the labour and the price of the materials (as to the correctness of which cost and price the certificate of the Project Engineer cum Estate officer shall be final and conclusive against the contractor) and crediting him with the value of the work done; in all respects in the same manner and at the same rates as if it had been carried out by the contractor under terms of this contract, and in that case

the certificate of the Project Engineer cum Estate officer as to the value of the work done shall be final and conclusive against the contractor.

(c) Recovery of extra cost on unexecuted work

To measure up the work of the contractor and to take such part thereof as is remaining unexecuted out of his hands and to give it to another contractor to complete it in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (as to the amount of which excess expenses the certificate in writing of the Project Engineer cum Estate officer shall be final and conclusive) shall be borne and paid by the original contractor and shall be deducted from any money due to him by Institute Otherwise the amount will be treated as outstanding due from the agency.

(d) Action against unsatisfactory progress

If the contractor does not maintain the rate of progress as required under **Clause 2** and if the progress of any particular portion of work is unsatisfactory even after taking action under **Clause 2(c)** and **2(d)**, the Project Engineer cum Estate officer shall be entitled to take action under **Clause 3(b)** or **3(c)** at his discretion in order to maintain the rate of progress after giving the contractor 10 days notice in writing whereupon the contractor will have no claim for any loss sustained by him owing to such actions.

(e) No compensation for loss sustained on advance action

In the event of any of the above courses being adopted by the Project Engineer cum Estate officer, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased, or procured any materials, entered into any agreements or made any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid the contractor shall not be entitled to recover or be paid any sum for any work thereof actually performed by him under his contract, unless and until the Project Engineer cum Estate officer shall have certified in writing the performance of such work and the amount payable in respect thereof, and he shall only be entitled to be paid the amount so certified.

(f) Recoveryof1%ofthecontractvaluetowardsthelaborerswelfarefundcreatedbytheGovernmentof Karnatakawillbeeffected in the running account bills of the contractor.

Clause 4. <u>CONTRACTOR TO REMAIN LIABLE TO PAY COMPENSATION IF ACTION IS NOT TAKEN UNDER CLAUSE-3</u>.

In any case in which any of the powers conferred upon the Project Engineer cum Estate officer by **Clause 3** thereof shall have become exercisable and the same shall not have been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor for which under any clause hereof he is declared liable to pay compensation or penalty amounting to the whole of his security deposit and the liability of the contractor for past and future compensation or penalty shall remain unaffected.

Power to take possession of or require removal of or sell contractor's properties.

In the event of the Project Engineer cum Estate officer taking action under **sub-clause (a)** or **(c) of Clause 3**, he may, if he so desires, take possession of all or any tools, plant, materials and stores, in or upon works or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or

allowing for the same in account at the contract rates; or in the case of contract rates not being applicable, at current market rates, to be certified by the Project Engineer cum Estate officer whose certificate thereof shall be final. In the alternative, the Project Engineer cum Estate officer may after giving notice in writing to the contractor or his clerk of the works, foreman or other authorised agent, require him to remove such tools, plant, materials or stores from the premises within a time to be specified in such notice; and in the event of the contractor, failing to comply with any such requisition, the Project Engineer cum Estate officer may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respect, and the certificate of the Project Engineer cum Estate officer as to the expense of any such removal; and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

Clause 5. GRANT OF EXTENSION OF TIME

(a) If the contractor shall desire an extension of the time for completion of the work, he shall apply in writing to the Project Engineer cum Estate officer before the expiry of the period stipulated in the tender or before the expiry of 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred, whichever is earlier and the Project Engineer cum Estate officer or other competent authority may if in his opinion, there are reasonable grounds for granting an extension, grant such extension as he thinks necessary or proper. The decision of such competent authority in this matter shall be final.

(b) The time limit for completion of the work shall be extended commensu rate with its increase in costoc casioned by alterations or additions and the certificate of the Project Engineer cum Estate officer or other competent authority as to such proportion shall be conclusive.

Clause 6. ISSUE OF FINAL CERTIFICATE – CONDITIONS REGARDING

On completion of the work the contractor shall report in writing to the Project Engineer cum Estate officer the completion of the work. Then he shall be furnished with a certificate by the Project Engineer cum Estate officer of such completion, but no such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed, all scaffolding, surplus materials and rubbish, and shall have cleaned thoroughly all wood work, doors, windows, wall, floor or other parts of any building, in or upon which the work has been executed, or of which he may have had possession for the purpose of executing the work, nor until the works shall have been measured by the Project Engineer cum Estate officer or other competent authority, or where the measurements have been taken by his Project Engineer until they have received the approval of the Project Engineer cum Estate officer or other competent authority, the said measurements being binding and conclusive against the contractor. If the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish, and cleaning on or before the date fixed for the completion of the work the Project Engineer cum Estate officer or other competent authority may, at the expense of the contractor, remove such scaffolding, surplus materials and rubbish, and dispose of the same as he think fit and clean off such dirt etc., as aforesaid and contractor shall be liable to pay the amount of all expenses incurred but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Note: CLOSURE OF CONTRACT PENDING COMPLETION OF MINOR ITEMS.

In cases where it is not desirable to keep the building contract open for minor items, such as flooring in the bathrooms, etc., which can be carried out only after installation of sanitary

work the main contract may be finalized after getting a supplementary agreement executed in the prescribed form by the same contractor for doing the residual work.

Clause 7. <u>Contractor to submit bills monthly in printed form</u>

(a) A bill shall be submitted by the contractor on or before 15th of each month for all items of work executed in the previous month as required by IISc. The Running account bills will be paid within three weeks from the date of submission of the bill in complete acceptable form after duly checked and certified by concerned Engineer, under normal circumstances.

Allbillsshallbepreparedintheprescribedprintedandelectronicforminpdf/Excelformatinquadruplicateandhanded over to the Project Engineer in charge of the work/ Project Engineer cum Estate officer's Office and acknowledgment obtained.

The charges to be made in the bills shall always be entered at the rates specified in the tender in full or in part as the case may be, in the case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender, the charges in the bills shall be entered at the rates hereinafter provided for such work.

(b) Scrutiny of Bills and measurement of work

The details furnished by the Contractor in the bill will be completely scrutinized and the said work will be measured by the Project Engineer in the presence of the Contractor or his duly authorized agent. The countersignature of the contractor or the said agent in the measurement book shall be sufficient proof to the correctness of the measurements, along with the Test certificates to be produced with the bill, which shall be binding on the contractor in all respects.

(c) One copy of the passed bill shall be given to the Contractor without any charge.

Clause 8. <u>PAYMENT PROPORTIONATE TO WORK APPROVED AND PASSED</u>.

No payment shall be made for any work estimated to cost rupees five thousand or less until after the whole of the work shall have been completed and certificates of completion given. But in the case of works estimated to cost more than Rs. 5,000 the contractor shall on submitting the bill and after due verification by the Project Engineer as per Clause 7(b) entitled to necessary Payment proportionate to the part of the work then approved and passed by the Project Engineer cum Estate officer or other competent authority whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor i.e. part payment of submitted RA bills is admissible to contractor. Any such reduced payment amount is admissible for adjustment in the successive RA Bills or Final Bill.

Payment at reduced rates

The rates for several items of works agreed to within shall be valid only when the items concerned are accepted as having been completed fully in accordance with the stipulated specifications. In cases where the items of work are not accepted as so completed, The Project Engineer cum Estate officer or other competent authority may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

Payment or intermediate certificates be regarded as advances:
All such intermediate payments shall be regarded as payments by way of advance against the final payments only and not as payments for work actually done and completed, and shall not preclude the Project Engineer cum Estate officer or other competent authority from requiring any bad, unsound imperfect or unskilful work to be removed or taken away and reconstructed or re-erected nor shall any such payment be considered as an admission for the due performance of the Contract or any part thereof in any respect or the accruing of any claim, nor shall it conclude determine or affect in any other way the powers of the Project Engineer cum Estate officer or other competent authority as to the final settlement and adjustment of the accounts, or otherwise or in any other way vary or affect the contract.

Submission of Final bill and its settlement
The contractor shall submit the final bill within one month from the date of actual completion of the work in all respects. His claims shall be settled within five months from the date of submission of the bill in complete acceptable form after duly checked and certified by concerned Engineer, under normal circumstances.

Disputed items
Note: The contractor shall submit a list of the disputed items within 30 days from the disallowance thereof and if he fails to do this, his claim shall be deemed to have been fully waived and absolutely extinguished.

Clause 9. Definition of Work :

a. The expression `Work' or 'Works' where used in these conditions, shall unless there be something in the subject or context repugnant to such construction, be construed to mean the work or works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.

b. Work to be executed in accordance with specifications, drawings, orders etc.

The contractor shall execute the whole and every part of the work in the most sound and substantial and workmanlike manner, and in strict accordance with the specifications both as regards materials and workmanship. The contractor shall also conform exactly, fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the Project Engineer cum Estate officer or other competent authority and lodged in his office and to which the contractor shall be entitled to have access at such office, or on the site of the work for the purpose of inspection during office hours. The contractor shall also be responsible for the delivery of structure in sound conditions and the execution of the work strictly in accordance with the specifications of the work.

c. Action where there is no specification

In the case of any class of work for which there is no such specification, then in such a case of the work shall be carried out in all respects in accordance with the instructions and requirements of the Project Engineer cum Estate officer or other competent authority.

d. Work as per Specifications and IS Codes.

The detailed specification, which forms a part of contract, accompanies the tender document. In carrying out the various items of work as described in Schedule B of the tender documents and the additional, substituted, altered items of work, this detailed specification shall be strictly adhered to, supplemented by relevant provisions of Indian

standard specifications, the code of practice; etc., The Indian standard specification, National Building Code and the code of practice to be followed shall be the latest versions of those listed in the detailed technical specifications. Any class of work, not covered by the detailed technical specifications, shall be executed in accordance with the instructions and requirements of the Project Engineer cum Estate officer and the relevant provisions of the Indian standard specifications.

Clause 10. Alteration in quantity of work, specifications and designs, Additional work, deletion of work

The Project Engineer cum Estate officer shall have power to make any alternations in, omissions from additions to or substitutions for the original specification, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work. For that purpose or if for any other reason it shall in his opinion be desirable, he shall have power to order the Contractor to do and the contractor shall do any or all the following: -

a) Increase or decrease the quantity of any work included in the contract.
b) Omit any such work.
c) Change the character or quality or kind of any such work,
d) Change the levels, lines, positions and dimensions of any part of the work,
e) Executeadditionalworkofanykindnecessaryforthecompletionoftheworksand
f) Change in any specified sequence, methods or timing of construction of any part of the work.

Contractor bound by Project Engineer cum Estate officer's instructions

The Contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Project Engineer cum Estate officer or other competent authority and such alteration shall not in any way vitiate or invalidate the contract.

Standard Quantity Take-off (SQT)

Contractor within **14 days** of Issue of LOI to submit the Project Manager & seek approval for the Standard quantity Take-off sheets for all the items mentioned in the Tender BOQ, after due referencing the Tender/ GFC drawings and the Technical Specification. Upon approval, the SQT shall remain the base document for initiating any change orders/ variation in accordance to Clause 31, tracking the daily project progress, and for the measurement sheets.

Orders for variations to be in writing

1. No such variations shall be made by the Contractor without an order in writing of the Project Engineer cum Estate officer; provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is the result of the quantities exceeding or being less than those stated in the 'Schedule B' provided also that if for any reason the Project Engineer cum Estate officer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order without any confirmation in writing of such verbal order given by the Project Engineer cum Estate officer, whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of the clause; provided further that if the Contractor shall within seven days confirm in writing to the Project Engineer cum Estate officer and if such confirmation is not contradicted in writing within fourteen days by the Project Engineer cum Estate officer, it shall be deemed to be an order in writing by the Project Engineer cum Estate officer.

2. **a)**Any additional work which the contract or may be directed to do in the manner above specified as part of the work shall be carried out by the Contract or on same conditions in all respects on which he agreed to do the main work and same rates as are specified in the tender for the main work. However, change in the Undertaking rates tendered and accepted shall be considered in respect of items under which the quantity of work performed exceeds tendered quantity by more than 25 percent and this actual change in rate will be restricted only to such excess quantity (i.e. beyond 125 percent of the tendered quantity).

(b) Rate for excess quantity beyond 125 percent of tendered quantity

The Additional quantity which exceeds 125 percent of the tendered quantity shall be paid at the rates entered in or derived from Schedule of Rates prevalent at the time of executing additions and alterations plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates (KPWD) of the year in which the tender is accepted (as per the comparative Statement prepared at the time of acceptance of the tender).

(c) Rates for additional, substituted, altered items of work

If the additional, substituted or altered work includes any class of work for which no rate is specified in the contract, then such work shall be carried out at the rates specified for or derived from similar item of work in the agreement. In the absence of similar items in agreement, rate shall be as specified for or derived from similar items in the schedule of rates of KPWD prevalent at the time of execution of such additional substituted or altered items of works, plus or minus the overall percentage of original tendered rates over the current schedule of rates of (KPWD) the year in which tender is accepted as mentioned in sub clause (b) above. With regard to the question whether the additional, substituted or altered item/items of work/works is / are similar or not, to that/those in the agreement / in the Schedule of Rates of KPWD and the decision of the CCMD shall be final and binding on the contractor.

(d) Determination of rates for items not found in Estimate or Schedule of Rates

If the rates for additional, substituted or altered work cannot be determined in the manner specified in sub **clauses (b)** and **(c)** above, then the contractor shall within 7 days of the date of receipt by him of the order to carry out the work, inform the Project Engineer cum Estate officer of the rates which it is his intention to charge for such class or work, supported by analysis of the rate or rates claimed. Thereupon the Project Engineer cum Estate officer shall determine the rate or rates on the basis of observed data and failing this, on the basis of prevailing market rates. Under no circumstances the contractor shall suspend the work on the plea of non- settlement of rates for items falling under this clause. In the event of any dispute regarding the rates for such items the decision of Project Engineer cum Estate Officer, CCMD shall be final.

Working out the data rates for non-SR/ non tendered items shall be based on the procedures laid down in the standard rate analysis format of KPWD Bangalore circle Bangalore. The data rates shall be approved by the Project Engineer cum Estate Officer, CCMD and shall be binding on the contractor.

Clause 11. <u>TIME LIMITS UNFORSEEN CLAIMS</u>

Under no circumstances whatever shall the contractor be entitled to any compensation from Institute on any account unless the contractor shall have submitted claim in writing to the

Project Engineer cum Estate officer or other competent authority within 30 days of the cause of such claim occurring.

Clause 12. NO CLAIM TO ANY PAYMENT OR COMPENSATION FOR DELETION OF WHOLE OR PART OF WORK

(a) If at anytime after the execution of the contract documents, the Project Engineer cum Estate officer or other competent authority shall, for any reason whatsoever, require the whole or any part of the work as specified in the tender, to be stopped for any period or require the whole or part of the work(i)not to be carried out at all or(ii)not to be carried out by the tendered contractor, he shall give notice in writing of the fact to the contractor who will there upon suspend or stop the work totally or partially as the case may be. In any such case, except as provided here under, the contractor shall have no claim to any payment of compensation what so ever on account of any profit or advantage which he might have derived from the execution of the working full but which he did not so derive in consequence of the full amount of the work not having been carried out, or on account of any loss tha the may be put on account of materials purchased or agreed to be purchased, or for unemployment of labour recruited by him. He shall not also have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions, which may involve any curtailment of the work, as originally contemplated.

(b) Payment for materials already purchased or ordered by contractor.

Where, however, materials have already been purchased or agreed to be purchased by the contractor before receipt by him the said notice the contractor shall be paid for such materials, at the rates determined by the Project Engineer cum Estate officer or other competent authority provided they are not in excess of requirements and are of approved quality, and/or shall be compensated for the loss, if any, that he may be put to, in respect of materials agreed to be purchased by him, the amount of such compensation to be determined by the Project Engineer cum Estate officer or other competent authority whose decision shall be final.

(c) Labour charges during stoppage of work

If the contractor suffers any loss on account of his having to pay labour charges during the period during which the stoppage of work has been ordered under this clause, the contractor shall on application, be entitled to such compensation on account of labour charges as the Project Engineer cum Estate officer or other competent authority, whose decision shall be final, may consider reasonable. Provided that the contractor shall not be entitled to any compensation on account of labour charges if in the opinion of the Project Engineer cum Estate officer or other competent authority, the labour could have been employed in the same locality by the contractor for the whole or part of the period during which the stoppage of the work has been ordered as aforesaid.

(d) Time limit for stoppage of work

The period of stoppage ordered by the Project Engineer cum Estate officer or other competent authority should not ordinarily exceed six months. Thereafter the portion of works stopped may be treated as deleted from this agreement if a notice in writing to that effect is given to

the Project Engineer cum Estate officer or other competent authority by the contractor within seven days after the expiry of the above period.

Execution of work deleted:

The portion of work thus deleted may be got executed from the same contractor on supplemental agreement on mutually agreed rates, which shall not exceed current Schedule of Rates plus or minus tender percentage.

Clause 13. ACTION AND PENALTY IN CASE OF BAD WORK

If at any time before the security deposit is refunded to the contractor, it shall appear to the Project Engineer cum Estate officer or other competent authority that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Project Engineer cum Estate officer or other competent authority to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or articles complained of may have been paid for, the contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified on whole or in part as the case may require, or if, so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Project Engineer cum Estate officer or the competent authority in the written intimation aforesaid, the contractor shall be liable to pay a penalty not exceeding one percent on the amount of the estimate for every day not exceeding ten days during which the failure, so continues and in the case of any such failure the Project Engineer cum Estate officer or other competent authority may rectify or remove, and re-execute the work or remove and replace the materia1s or articles complained of, as the case may be at the risk and expense in all respects of the contractor should the Project Engineer cum Estate officer or other competent authority for any valid reasons consider that any such inferior work or materials as described above is to be accepted or made use of, it shall be within his discretion to accept the same at such reduced rates he may fix thereof.

Clause 14. WORK TO BE OPEN TO INSPECTION - CONTRACTOR OR RESPONSIBLE AGENT TO BE PRESENT

(a) All works under or in course of execution or executed in pursuance of the contract shall at all time be open to the inspection and supervision of the Project Engineer cum Estate officer or other competent authority and his Engineer-in-charge, and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Project Engineer cum Estate officer or other competent authority Project Engineer to visit the work shall have been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for the purpose. Orders given to the contractor duly authorized agent shall be considered to have the same force and effect as if they had been given to the contractor himself.

(b) Employment of Minimum Technical Staff

The Contractor shall employ the following technical staff during execution of this work:

a) One qualified Graduate Engineer &One qualified Diploma Engineer, when the cost of the work to be executed up to 1Crore,
b) Two qualified Graduate Engineer& Three qualified Diploma Engineer, when the cost of the work to be executed from 1 Crore to 10 crores;
c) Three qualified Graduate Engineer & Six qualified Diploma Engineer, when the cost of the work to be executed above 10 crores;
d) In addition to (i) and (ii) above, the contractor shall employ different types of such technical personnel as may be required and sufficient for execution of work and directed by the Project Engineer cum Estate officer to ensure efficient execution of work.
e) The technical staff so employed, should be available at site whenever required by Engineer in-charge to take instructions.
f) If the contractor fails to employ the technical staff as aforesaid, he shall be liable to pay a sum of Rs. 25000 (Rupees Twenty thousand only) for each month of default in the case of Graduate Engineers and Rs.15000 (Rupees Ten thousand only) for each month of default in case of Diploma Holders.
g) If the Contractor himself possesses the required qualification and is available at the site for receiving instructions from the Project Engineer cum Estate officer and other competent authority vide **sub-clause(a**)above it will not be necessary for the technical staff to be available at site for receiving instructions.

Clause 15. NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than five days' notice in writing to the Project Engineer cum Estate officer or his Project Engineer in charge of the work before covering up or otherwise placing beyond the reach of the measurement any work in order that the same may be measured; and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement, and shall not cover up or place beyond the reach of measurement, and work without the consent in writing of the Project Engineer cum Estate officer or other competent authority or his Project Engineer in charge of work; and if any work shall be covered up or placed beyond the reach of measurement, without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Clause 16. CONTRACTOR LIABLE FOR DAMAGE DONE, AND FOR IMPERFECTIONS FOR TWELVE MONTHS AFTERCERTIFICATE OF COMPLETION

If the Contractor or his workmen or servants shall break, deface, injure or destroy any part of a building in which they may be working, or any building, road fence, enclosure or grassland or cultivated ground contiguous to the premises on which the work or any part thereof is being executed, or if any damage shall be done to the work, while it is in progress from any cause whatever or if any imperfections become apparent in it within Twelve months of the grant of a certificate of completion, final or otherwise, by the Project Engineer cum Estate officer or other competent authority the contractor shall make good the same at his own expenses, or in default the Project Engineer cum Estate officer or other competent authority may cause the same to be made good by other workmen, and deduct the expenses (of which the certificate of the Project Engineer cum Estate officer or other competent authority shall be final) from any sums that may be due or may thereafter become due to the contractor, or from his Security Deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

The Defects liability period shall be extended for as long as defects remain to be corrected. Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Institute.

Clause 17. CONTRACTOR TO SUPPLY PLANT, LADDERS, SCAFFOLDINGS, ETC., ANDIS LIABLE FOR DAMAGES ARISINGFROM NON-PROVISION OF LIGHT, FENCING ETC

The contractor shall supply at his own cost all materials, plant, tools, appliance, implements, ladders, scaffolding, and temporary works required for the proper execution of the work whether in the original, altered or substituted form and whether included in the specification, or other documents forming part of the contract or referred to in these conditions or not, and which may be necessary for the purpose of satisfying or complying with the requirements of the Project Engineer cum Estate officer or other competent authority as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore, to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or the materials. Failing this, the same may be provided by the Project Engineer cum Estate officer or other competent authority at the expense of the contractor and expense may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. The contractor shall provide necessary fencing and lights required to protect the public from accident, and shall also be bound to bear the expense of defense of every suit, action or other legal proceedings, that maybe brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any suit, action or proceedings to any person, or which may with the consent of the contractor be paid for compromising any claim by any such person.

Clause 18. Measures for prevention of fire

The contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permit from the Project Engineer cum Estate officer. When such permission is given, and also in all cases when destroying cut or dug up trees, brushwood grass, etc., by fire the contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property.

Clause 19. Liability of contractor for any damages done in or outside work Area.

Compensation for all damages done by contractor or his men whether in or beyond the limits of Institute property including any damage caused by spreading of fire mentioned in Clause 18 shall be estimated by the Project Engineer cum Estate officer and the estimate of the Project Engineer cum Estate officer, subject to the decision of the Centre for Campus Management and Development on appeal shall be final and the contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the contractor as the damages in the manner prescribed in clause 1(c) or deducted by the Project Engineer cum Estate officer or other competent authority from any

sums that may be due or become due from Institute to the contractor under this contract or otherwise.

The contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and shall pay any damages and cost that may be awarded by the court in consequence.

Clause 20. Work on Notified Holiday

No work shall be done on any notified holiday without the sanction in writing of the Project Engineer cum Estate officer or other competent authority.

Clause 21. WORK NOT TO BE SUBLET

(a) The contract shall not be assigned or sublet by the contractor. However, any specific portion of the work which is of a specialized nature and normally not executable by a general contractor could be got done by the specialized agencies which are executing such works, after obtaining the specific approval of the Project Engineer cum Estate officer in writing in each case. Such consent to sublet the work, if given, 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 sub-contractor or his agents, servants or workmate as fully as if they were the acts, defaults or neglects of the contractor, his agents, servants or workmen.

Consequences of subletting work without approval, becoming insolvent, bribing etc., by contractor and action against the contractor.

If the contractor shall assign or sublet his contract or any portion thereof without the specific approval of the Project Engineer cum Estate officer or attempts to do so or become insolvent or commence any proceedings to get himself adjudicated as insolvent or make any composition with his creditors or attempts so to do or if any bribe, gratuity, or indirectly be given, promised or offered by the contractor or any of his servants or agents to any officer or person in the employ of Institute in any way relating to his office or employment or if any such officer or person in the employment or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Project Engineer cum Estate officer or other competent authority may thereupon by notice in writing rescind the contract and the security deposit of the contractor shall thereupon stand forfeited and be absolutely at the disposal of Institute and the same consequences shall ensure as if the contract had been rescinded under Clause 3 here of and in addition, the contractor shall not be entitled to recover or be paid for any work actually performed under contract.

(b) Recovery of excess payments based on excess measurements and action against contractor.

Whenever it is noticed that excess payments have been made to the contractor based on excess measurements recorded by the Project Engineer in the measurement book and countersigned by the contractor or his duly authorized agent, action shall be taken to recover the excess payments together with interest immediately. Action may also be taken to remove the name of the contractor from the approved list of contractors and also to blacklist him.

Change in classification of excavations accepted not permitted.

Once the measurements mentioning the classification of the excavations are recorded in the measurement book and the same is signed by the contractor or his authorized agent in token of acceptance, no request for reclassification by the contractors shall be entrained.

(c) Criminal proceedings against IISc Officer and Contractor for the lapses.

Institute also reserve the right to initiate criminal proceedings against the concerned Institute Officers who are directly responsible for the lapse and the contractors who have colluded with the officers of the Institute in the lapse and fraudulently received amounts not due to them legitimately.

Clause 22. SUM PAYABLE BY WAY OF COMPENSATION TO BE CONSIDEREDAS REASONABLE COMPENSATIONWITHOUT REFERENCE TO ACTUAL LOSS.

All sums payable by a contractor by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied for the use of Institute without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.

Clause 23. SETTLEMENT OF DISPUTES -TIME LIMIT FOR DECISION

(a) If any dispute or difference of any kind whatsoever were to arise between the Project Engineer cum Estate officer and the contractor regarding the following matters namely,

(i) The meaning of the specification's designs, drawing and instructions here in before mentioned,

(ii) The quality of workman ship or materials used on the work and

(iii) Any other question, claim right, matter, thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specification, estimates, instructions, or orders, or those conditions, failure to execute the same whether arising during the progress of the work, or after the completion, termination or abandonment thereof, the dispute shall, in the first place, be referred to the Centre for campus management and Development who have jurisdiction over the work specified in the contract. The Centre for campus management and Development shall within a period of fifteen days from the date of being requested by the Contractor to do so give written notice of its decision to the Contractor.

If the decision of the Centre for campus management and Development is not acceptable to the contractor, he may approach the **Director, IISc within** a period of 15 days for settlement.

(b) Director, IISc decision's final.

Subject to other form of settlement hereafter provided, the Director's decision in respect of every dispute or difference so referred shall be final binding upon the contractor. The said decision shall forthwith be given effect to and contractor shall proceed with the execution of the work with all due diligence.

(c) Remedy when Director's decision is not acceptable to contractor.

In case the decision of the Director is not acceptable to the contractor, he may approach the Law Court at Bangalore for settlement of dispute after giving due written notice in this regard to the Director within a period of ninety days from the date of receipt of the written notice of the decision of the Director. Further, the Bangalore courts alone shall have the exclusive jurisdiction.

(d) Time limit for notice to approach Court of law by contractor

If the Director has given written notice of his decision to the contractor and no written notice to approach the law court has been communicated to him by the contractor within a period of ninety days from receipt of such notice, the said decision of Director shall be final and binding upon the contractor.

(e) Time limit for notice to approach law court by contractor when decision is not given by Director, IISc as at(b).

If the Director fails to give notice of his decision within a period of ninety days from the receipt of the contractor's request in writing for settlement of any dispute or difference as aforesaid, the Contractor may within ninety days after the expiry of the first named period of ninety days approach the Law Courts at Bangalore giving due notice to the Director.

(f) Contractor to execute and complete work pending settlement of dispute.

Whether the claim is referred to the Director or to the Law Courts, as the case may be, the contractor shall proceed to execute and complete the works with all due diligence pending settlement of the said dispute or differences.

(g) Obligations of the Project Engineer cum Estate officer and contractor shall remain unsettled during considerations of dispute.

The reference of any dispute or difference to the Director or the Law Court may proceed notwithstanding that the works shall then be or be alleged to be complete, provided always that the obligations of the Project Engineer cum Estate officer and the contractor shall not be altered by reason of the said dispute or difference being referred to the Director or the Law Court during the progress of the works.

Clause 24. <u>CONTRACTOR TO PAY COMPENSATION UNDER WORKMEN'S COMPENSATION ACT.</u>

(a) The contractor shall be responsible for and shall pay any compensation to his own workmen payable under the relevant Workmen's Compensation Act for injuries caused to the workmen. If Institute pays such compensation on behalf of the contractor it shall be recoverable by Institute from the contractor under as per relevant clauses.

(b) Contractor to pay expenses of providing medical aid to workmen.

The contractor shall be responsible for and shall pay the expenses of providing medical aid to any workman who may suffer a bodily injury as a result of an accident. If Institute incurs such expenses, the same shall be recoverable from the contractor forthwith and be deducted

without prejudice to any other remedy of Institute, from any amount due or that may become due to the contractor.

Clause 25. CONTRACTOR TO PROVIDE PERSONAL SAFETY EQUIPMENT FIRST AID APPARATUS, TREATMENT etc.

The contractor shall provide all necessary personal safety equipment and first aid apparatus for the use of the persons employed on the site and shall maintain the same in good condition suitable for immediate use, at any time and shall comply with the following regulations in connection therewith: -

- The worker will be required to use the equipment so provided by the contractor and the contractor shall take adequate steps to ensure proper use of the equipment by those concerned.
- When work is carried on in proximity to any place where there is a risk of drowning; all necessary steps shall be taken for the prompt rescue of any person in danger.
- Adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during he course of the work.

Clause 26. Minimum Age of Person Employed by Contractor

(a): No contractor shall employ

- Anypersonwhoisunderageof18years.
- Whodoesnotproduceavalidcertificateofvaccinationagainstepidemicdeceasesinrespectof himself/herself as well as all the members of his/her family.

(b) The contractor shall provide potable water facilities to the workers. Similar amenities shall be provided to the workers engaged on large works in urban area.

(c) Removal of persons not satisfying conditions(a)(i)&(ii)

The Project Engineer cum Estate officer or other authority is authorized to direct the removal or to remove through - his own agency, from the work any person referred to in sub-clauses (a) above not satisfying these conditions and no responsibility shall be accepted by the Institute for any delay caused in the completion of the work by such directions for removal.

(d) Payment of fair and reasonable wages by contractor.

The contractor shall pay fair and reasonable wages, which shall not be less than the minimum wages fixed by Govt. of India from time to time to the workmen employed by him in the contract undertaken by him. In the event of any dispute arising between the contractor, and his workmen on the ground that the wages paid are not fair and reasonable the dispute shall be referred without delay to the Project Engineer cum Estate officer or other competent authority, who shall decide the same. The decision shall not in any way affect the conditions in the contract regarding the payment to be made by Institute at the agreed tender rates.

Clause 27. CONTRACTOR NOT ENTITLED TO ANY CLAIM OR COMPENSATION FOR DELAY IN EXECUTION OF WORK INBORROW PITS.

The contractor shall not be entitled to claim compensation if there is any delay in the execution of the work on account of water standing in borrow pits and Compartments. The rates are inclusive for hard or cracked soil, excavation in mud, sub-soil water or water standing in borrow pits and no claim for extra rate shall be entertained, unless otherwise specified.

Clause 28. METHOD OF PAYMENT OF BILLS

Payment to contractors shall be made by RTGS by the Institute.

Clause 29. SET OFF AGAINST ANY CLAIM OF INSTITUTE

Any sum of money due and payable to the contractor (including the security deposit refundable to him) under this contract may be appropriated by the Institute and set off against any claim of Institute in respect of a payment of a sum of money arising out of or under any other contract made by the contract with the Institute.

Clause 30. RATES INCLUSIVE OF SALES TAX AND LABOUR CESS AND ROYALTY

(a) The rates to be quoted by the contractor shall be inclusive of all taxes like GST, Labour cess, Royalty etc., No extra payment on this account will be made to the contractor.

(b) When there is a change in existing taxes from time to time i.e. upward or downward is admissible accordingly

(c) All quarry fees, octroi dues levied by the state or any local body or authority and ground rent, if any, charged by the Project Engineer cum Estate officer for stacking materials should be paid by the contractor.

Clause 31. IMPORTANCE OF SAFETY

In addition to Contractor's Contractual Obligations on Safety as per the relevant clauses stated, The Contractor shall comply with all safety standards to the satisfaction of the Employer's Representative.

In respect of all labour, directly or indirectly employed on the project for the performance and execution of the Contractor's Work under the Contract, the Contractor shall at its own expense arrange for all the safety provisions as listed in (i) Safety codes of C.P.W.D. and Bureau of Indian Standards, (ii) The Electricity Act, (iii) The Mines Act, and Regulations, Rules and Orders made there under and such other acts as applicable. Precautions as stated in the safety clause are the minimum necessary and shall not preclude the Contractor taking additional safety precautions as may be warranted for the particular type of work or situations. Also mere observance of these precautions shall not absolve the Contractor of his liability in case of loss or damage to property or injury to any person including but not limited to the Contractor's labour, the Employer's, Architect's, Employer's Representative's and Project Manager's representatives or any member of the public or resulting in the death of any of these.

The Contractor shall institute and implement to the satisfaction of the Project Manager a construction safety programme, including:

1 Preparing a Site-specific written safety programme consistent with the EHS Plan, Indian law and best practices, As a minimum, the programme shall require applicable safety equipment for all workers, use of barriers and barricades around potentially dangerous are as,

protection of workers working under elevated conditions, accident reporting, first aid provision set.

2 Weekly safety reviews and 'risk assessments' shall be carried out in conjunction with the Project Manager and the Employer in order to identify potential safety hazards and to mitigate against them.

3 Attendingweeklyorasscheduledsafetymeetingsatsiteconductedbythesitesafetyrepresentativeo fproject manager

4 The Contractor will be required to provide all personnel entering the Site an Identity and safety rules card and verbal explanation of the safety programme.

5 Requiring all Sub-Contractors and other workers under the responsibility of the Contractor (including the Vendors or later phases of the construction of the Project) to adhere to the written safety programme as per approved format.

Experienced safety officers with adequate number of supporting personnel shall be appointed by the Contractor for full time on the site during the Contract period.

NON-COMPLIANCE OF REGULATIONS

If the Project Manager or the Employer's Representative notifies the Contractor of non-compliance with the foregoing regulations, the Contractor shall immediately, if so directed, or in any event not more than eighteen (18) hours after receipt of such notice, make all reasonable efforts to correct such non-compliance. If the Contractor fails to do so, the Employer may suspend all or any part of the Work. When the Contractor has undertaken satisfactory corrective action, Employer shall lift the suspension of the Work. The Contractor shall not claim any extension of time to complete the Work or additional fees due to any such work suspension.

The Client reserves the right to levy penalty if the safety norms such as not wearing helmets, safety gloves/belts/shoes/jackets. etc., even after a written notice by the enforcing authority, a penalty of Rs.10,000/- per day per event or till the safety norms are adhered to in addition to stopping of work till the safety norms are adhered

Clause 32Refund of Security Deposit (EMD & SD):

The Security Deposit lodged/paid by a Contractor shall be refunded to him after the final bill is paid or after the successful completion of defect liability period, during which period the work should be maintained by the Contractor in good order, whichever is later.

Clause 33BAR CHART / CPM CHART:

BAR chart /CPM chart shall be produced during agreement by the contractor. According to the bar chart work is to be executed otherwise penalty will be levied for the delay of work

9.THE ARTICLES OF AGREEMENT

This Agreement is made at Bangalore, on this **XXth day of MONTH** in the year **TWO THOUSAND AND TWENTY FIVE (XX.XX.2025**).

BY AND BETWEEN

INDIAN INSTITUTE OF SCIENCE herein referred as IISc, a Trust registered under the Charitable Endowments Act, 1890, a deemed University and an autonomous Institution funded by the Ministry of Education, Government of India having its office at **Sir C.V Raman Road, Malleswaram, BANGALORE 560 012**, represented by the **Registrar IISc**, Bangalore (hereinafter referred to as the IISc which expression shall unless repugnant to the context or meaning thereof, mean and include its successors in interest, trustees and permitted assigns) of the ONE PART
AND
M/s xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Bangalore – 56003xx, hereinafter referred to as the "CONTRACTOR", (which expression shall unless repugnant to the context or meaning thereof, mean and include their partners, their respective heirs, executors, administrators and assigns) on the OTHER PART.

RECITALS

A.WHEREAS the IISc is desirous of getting the work of **"Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore."**. "(hereinafter called the work) executed by the Contractor at the rates quoted by him amounting to Rs.xxxxxxxx (Rupees xxxxxxxxxxxxxxxxxxxxx only) Inclusive of all Taxes which is xxx% Above/Below the estimated amount put to tender.

B. WHEREAS the Contractor has agreed to execute the aforesaid work on terms and conditions mentioned herein and subject to Tender Conditions of Contract and in accordance with the particular specifications, general notes and the schedule of quantities, schedule of rates, payment, and penalty condition, to the satisfaction of the IISc, Bangalore

NOW THIS AGREEMENT WITNESSETH AND THE PARTIES HERETO AGREE AND SOLEMNL AFFIRM AS FOLLOWS:

1. In consideration of the payment to be made to them as hereinafter provided, the contractor shall, subject to the terms, conditions, specifications, schedule of quantities, drawings, etc., more particularly stated in the Schedules aforesaid, execute and complete the work within **9 Months** for the work after 10 days of issuance of work order or from the date of handing over of site, whichever is later.

2. IISc shall pay to the contractor such sums as shall become payable hereunder at the time and in the manner specified in the conditions contained in the schedule aforesaid.

3. The time allowed for carrying out the work as entered in the tender Agreement shall be strictly observed by the contractor and shall be deemed to be the essence of the contract on the part of the contractor and shall be reckoned from 10 days after the date on which the work order to commence the work is issued to the Contractor or the date of handing over of site, whichever is later. The work shall throughout the stipulated period of the contract be proceeded with all due diligence and the Contractor shall pay compensation an amount equal to one percent, or such smaller amount, as the Director, Indian Institute of Science (whose decision shall be final) may decide on the amount of estimated cost of the whole work as shown in the tender for every day that the work remains un-commenced or unfinished, after scheduled dates.

4. The contractor shall ensure good progress during the execution of the work be bound in all cases in which the time allowed for any work exceeds one month (save for special jobs) to complete **Mile stone-1** i.e. 15% of the whole work before the time allowed under the contract has elapsed, **Mile stone-2** i.e. 35% of the work before the time has elapsed, **Mile stone-3** i.e. 60% of the work before the time has elapsed, **Mile stone-4** i.e.80% of the work before of the time has elapsed,100% of the work before completion of such time has elapsed.

However, for special jobs if a time schedule has been submitted by the contractor and the same has been accepted by the Project Engineer-cum-Estate Officer, CCMD the contractor shall comply with the said schedule. In the event of the Contractor failing to comply with the conditions he shall be liable to pay as compensation an amount equal to one percent or such smallest amount, as the Director, Indian Institute of Science (Whose decision in shall be final), may decide on the said estimated cost of the whole work for every day that the due quantity of work remains incomplete;

provided always that the entire amount of compensation to be paid under the provisions of this clause shall not exceed ten (10%) percent of the estimated value of the contract as shown in the tender, provided further that in the event of contractor making up the short fall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the Contractor.

5. The Engineer in charge shall review the progress of all works with the contractor once every week. Such a review shall take into account the programme fixed for the previous week, obligations on the part of the Institute for issue of drawings etc., and also the obligations on the part of the Contractor. The review shall also examine the accumulated delays by the contractor if any and mitigation measures proposed by the contractor to overcome the delay. In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the IISc and the contractor. This record should be signed in full and dated both by the Project Engineer and the Contractor.

6. The Director, Indian Institute of Science, without prejudice to its rights under the contract in any respect of any delay or inferior workmanship or otherwise, or to any claim for damages in respect of any breaches of the Contract and without prejudice to any rights of remedies under any of the provisions of this contract or otherwise and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases: -

(i) If the contractor having been given by the Project Engineer-cum-Estate Officer, CCMD a notice in writing to rectify reconstruct or replace any defective work or that the work is being performed in any inefficient or otherwise improper or unworkmanlike manner, shall omit to comply with the requirements of such notice for a period of seven days of such notice thereafter or if the contractor shall delay or suspend the execution of the work so that in the judgment of the Project Engineer-cum-Estate Officer, CCMD (which shall be final and binding) either they will be unable to secure completion of the work by the date for completion of the work or they had already failed to complete the work by that date.

(ii) If the Contractor being a company passes a resolution or if the Court passes an order to wind up the company or if a receiver or a manager is appointed on behalf of the creditors of the company or under circumstances which entitles the Court or the creditors to appoint a receiver or manager which would entitle the Court to make a winding-up order.

(iii) If the Contractor commits breach of any of the terms or conditions of this contract.

(iv) If the contractor assigns or sublets without written approval of the Project Engineer-cum-Estate Officer, CCMD or becomes insolvent.

The Director of the Institute shall have following powers:

a) To determine or rescind the Contract as aforesaid (in which termination or recession notice in writing to the Contractor underhand of the Project Engineer-cum-Estate Officer, CCMD shall be conclusive evidence). Upon such determination or recession the security deposit of the Contractor shall be liable to be forfeited and shall absolutely be at the disposal of Institute.

(2) To employ labor paid by the Institute and supply materials to carry out the work or any part by debiting the Contractor with the cost of the labor and the price of the materials (of the amount of which cost and price certified by the Project Engineer-cum-Estate Officer, CCMD shall be final and conclusive against the Contractor) and crediting him with the value of the work done in all respect on the same manner and at the same rates as if it has been carried out by the contractor under the term of his contract. The certificate of the Project Engineer-cum-Estate Officer, CCMD as to the value of the work done shall be final and conclusive

against the contractor, provided always that action under the sub-section shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the Institute are less than the amount payable to the contractor at his agreement rates, the difference shall not be paid to the Contractor.

(3) After giving notice to the contractor to measure up the work of the contractor and to take such part thereof as shall be un-executed out of their hands and to give it to another contractor to complete in which case any expenses which may be incurred in excess a sum of which would have been paid to the original contractor if the whole work had been executed by him (of the amount of which excess the certificate in writing of the Project Engineer-cum-Estate Officer, CCMD shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any monies due to him from the Institute under this contract or any other account whatsoever, of from his security deposit or the proceeds of sales thereof, or a sufficient part thereof as the case may be.

In the event of any one or more of the above courses being adopted by the Project Engineer-cum-Estate Officer, CCMD, the contractor shall have no claim to compensation for any loss sustained by them by reason of having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case of action is taken under any of the provisions, aforesaid, the contractor shall not be entitled to recover or be paid any sum for work thereto/for actually performed under this contract unless the Project Engineer-cum-Estate Officer, CCMD has certified in writing the performance of such work and the value payable in respect thereof and they shall only be entitled to be paid the value so certified.

7. The schedules above mentioned include the General Rules and Directions to Contractors and the following documents, viz.,
   i) Letter of Intent
   ii) Letter of Acceptance
   iii) Work Order
   iv) Conditions of Contract
   v) Contractor's Bid – Bill of Quantities
   vi) Technical Specifications
   vii) Drawings
   viii) The pre-Bid meeting proceedings and corrigendum
   ix) Any other document listed in the Contract Data as forming part of the contract shall form an integral part of the agreement and the decision of the Project Engineer-cum-Estate Officer, CCMD in reference to all matters of a dispute as to material and workmanship shall be final and binding on both the parties.

8. The IISc reserves the right of altering the drawings of the works and of adding to or omitting any item of work from or of having portions of the same carried out departmentally or otherwise and such alterations or variations shall not violate this agreement.
9. This agreement comprises the work aforesaid, and all subsidiary works connected therewith even though such works may not be shown on the schedule appended hereto.
10. In the event the contractor or their employees, agents, sub-contractors deface or destroy the property or the establishment belonging to IISc, the same shall be made good by the contractor at their own expenses.
11. The Contractor shall ensure cleanliness at the premises of IISc ensure cleaning of site and removal of debris every week. In any event the contractor ceases to comply the foregoing the IISc shall ensure the site cleaned at the expense of the contractor.
12. The Contractor shall at all time be responsible for the safety of their employees, agents, sub-contractors, and in any event during the commission of work or in their due course of work the IISc shall not be held responsible. The contractor shall defend, indemnify and hold the Institute

harmless from any liability or damage, law suits, penalties imposed by any State or Central Government or statutory body or by a third party for reasons of violation of any of statutory provisions or requirements by the contractor.

13. The Contractor shall adhere to the working conditions and its scope strictly and any act not in confirmation with the scope of work which is mutually accepted by both the parties shall only be done after prior approval and acceptance in writing by the Director.
14. The Contractor shall at any time be responsible for the completion of work in time, also the contractor shall be responsible to submit the final bill within one month after completion of the work.
15. Notwithstanding anything contained in the tender submitted by the contractor, all the clauses of this agreement shall be binding on both parties.
16. Where counter-terms and conditions, printed or copied, are offered by the contractor, the same shall not be deemed to have been accepted by the IISc, unless specific written acceptance thereof is furnished by the IISc. Notwithstanding the foregoing, no verbal agreement or inference from a conversation with any office members/representatives/employees of the IISc before, during, or after the execution of the agreement, shall in any way affect or modify any of the terms/obligations contained herein.
17. In the event the contract is terminated by the IISc due to any afore mentioned act/omission on the part of the contractor, or for any reason whatsoever, the IISc shall be entitled to engage the services of any other person, agency or Contractor to meet its requirement, without prejudice to its rights including claim for damages against the Contractor.

18. This agreement can be terminated by IISc with the prior written notice of Seven (7) days in the event of a breach of any of its terms of this agreement and even otherwise this Agreement may be terminated by IISc by giving a minimum of 7 days prior written notice to the Contractor.

19. The IISc shall be indemnified for all losses due to commissions and omissions of persons deployed by the contractor. If any loss or damage is caused to the IISc on account of any negligence, carelessness, acts of omissions. commissions of contractors, its employees or staff, the same shall be made good by the contractor. The contractor shall defend, indemnify and hold the Institute harmless from any liability or damage, law suits, penalties imposed by any State or Central Government or statutory body or by a third party for reasons of violation of any of statutory provisions or requirements by the contractor. The IISc shall not be liable for any damage or compensation payable to any workmen or to any person as a consequence of this work and the IISc shall be completely indemnified accordingly.

20. The contractor shall pay wages directly to its personnel The contractor shall also ensure that no amount by way of commission or otherwise is deducted from the wages of the workmen. The contract labourers deployed by the agency shall not involve in any theft/pilferage/damage to Institute property. After necessary investigations, if proved that the contractor or their personnel are responsible for the incident, the contractor is liable and will be penalized to the extent of the value of the loss and additionally Rs. 50,000/- for each such incident.

21. All terms and conditions, the scope of work, and other conditions as mentioned in the tender document will be diligently complied by the contractor. The terms and conditions, the scope of work, and other conditions mentioned in the tender documents shall form a part and parcel of this agreement.

22. The Contractor hereby agrees and affirms that during or subsequent to the performance of the duties under this Agreement, the Contractor shall maintain confidentiality and shall not divulge, communicate, use or appropriate any of the IISc Information, except to the extent necessary for the Contractor to fulfill his obligations or duties to the IISc under this Agreement. The Contractor shall not cause transmission, removal or transfer of tangible embodiments of, or files

from the IISc place of business, without the prior written consent of the IISc and shall not disclose any information of the IISc to any third part

23. In case of disputes including all questions relating to the performance of the obligations under this agreement and all the dispute and differences which shall arise either during or after the agreement period or other matters arising out of or relating to this agreement or payments to be made in pursuance thereof shall be decided by the Director of IISc whose decision shall be binding on the contractor. The Contractor hereby agrees to be bound by the decision of the Director, IISc.

24. **COURTS:**

Courts of appropriate jurisdiction situated in Bangalore City shall have exclusive jurisdiction.Any dispute or difference arising between the parties to the agreement in relation to any of the matters specified herein, shall be settled in the Courts of appropriate jurisdiction situated in Bangalore City which shall have exclusive jurisdiction in regard to any matter arising under or in relation to this agreement. Laws of India and the State of Karnataka, shall be applicable in this regard

25. **GOVERNING LAW**

This Contract shall be governed by the Law of India for the time being in force

IN WITNESS WHEREOF the parties hereto have set their respective hands the day and the year here in above written.

In the presence of:
Witness 1:

Signed by for and on behalf of the said Contractor.

(Company Name)

In the presence of:
Witness 2:

Signed by for and on behalf of the IISc.

REGISTRAR
INDIAN INSTITUTE OF SCIENCE
BANGALORE-12

MEMORANDUM OF WORK

INDIAN INSTITUTE OF SCIENCE, BANGALORE-12
ITEM RATE TENDER FOR WORK

1.	General Description	**Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore.**
2.	Estimated Cost	**Rs.12,61,08,627/-**
3.	Earnest Money	**Rs.12,61,086.00/-**
4	Date of Commencement of work	Within ten days from the date of issue of work order or the date of handing over the site whichever is later
5	Frequency of interim Certificate and payment	Once every month.
6.	Further Security Deposit	**6.5%** on the running account bills and final bill in addition to Earnest Money Deposit. When the S.D. deducted from the RA bills of the Contractor @ **6.5%** of the bill amount exceeds Rs.1.00 lakhs, the amount in excess of Rs.1.00 lakh may, at the request of the Contractor, be released to him against the production of a bank guarantee issued by a Nationalized Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the period mentioned in page 2 of Sl.No.1.
5.	Time allowed for the completion of work in all respects from the date of commencement of work	**9 Months**
6	Bills Of Quantities.	As per enclosure.
7	Defects liability period /release of security deposit.	The security deposit lodged/paid by a contractor shall be refunded to him after the final bill is paid or after Twenty Four **24 months** from the date of completion of the work, during which period the work so executed should be maintained by the contractor in good order, whichever is later.
8	Period for payment of Running Bill.	Four weeks from the date of submission of each Running account bill by the Contractor.

9	Period for submitting the final Bill.	One month from the date of virtual completion of the work by the Contractor.
10	Specifications.	The work shall be carried out strictly in accordance with the enclosed specifications and wherever items are not covered by those specifications in accordance with specifications/drawings /designs/requirements and directions of the Project Engineer-cum-Estate Officer, CCMD

I/We, hereby tender for the execution for the Indian Institute of Science, Bangalore-12 of the works specified in the under mentioned memorandum within the time specified in such memorandum at the rates specified therein and in accordance, in all respects, with the specifications, designs, drawings and instructions in writing which have been read by me/read and explained to me and with such materials as provided for by and in all other respects in accordance with such conditions as for as possible.

I/We hereby agree to abide by and fulfill all the terms and provisions of the conditions contained in the articles of agreement, which have been read by me/us or in default thereof to forfeit and pay to the Registrar, Indian Institute of Science or his successors he sums of monies mentioned in the said conditions

The sum of **Rs.12,61,086.00 (Rupees Twelve Lakhs Sixty One Thousand and Eighty Six Only)** has been deposited in cash/bank draft as Earnest Money the full value which is to be absolutely forfeited to the Registrar or his successors in Office should I/We fail to commence the work specified in the above memorandum and complete the same.

Dated this XX **day of XX 2025**.

Signature of the Contractor

Witness to Contractor/s Signature:
NAME
ADDRESS
OOCCUPATION

The above tender is hereby accepted by me on behalf of the Indian Institute of Science, Bangalore-12.

REGISTRAR
INDIAN INSTITUTE OF SICENCE
BANGALORE.

Indian Institute of Science, Bangalore-12
A P P E N D I X

1.Name of the work	**"Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore."**
2.Date of commencement of work	Within Ten days from the date of issue of work order or the date of handing over the site whichever is later
3.Time of Completion	**9 Months**
4.Frequency of interim Certificate and payment	Once in every month.
5.Further Security deposit	**6.5%** on the running bills and final bill in addition to earnest money deposit. When the S.D. deducted from the R.A. Bills of the contractor @ **6.5%** of the bill amount exceeds Rs.1.00 Lakhs, the amount in excess of Rs.1.00 Lakh may, at the request of the contractor, be released to him against the production of bank guarantee issued from a Nationalised /Scheduled Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.
6. Defects liability period / retention amount from the final bill/release of balance of deposit.	The security deposit lodged/paid by a contractor shall be refunded to him after the final bill is paid or after Twenty Four 24 months from the date of completion of the work, during which period the work so executed should be maintained by the contractor in good order, whichever is later.
7. Penalty for delay	In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per clause 2(b) and 2(c), the contractor shall be liable to pay as penalty an amount equal to one percent of the estimated cost of the balance work assessed according to the programme, for every day that the due quantity of work remains incomplete, provided always that the total amount of penalty to be paid under the provisions of this clause shall not exceed 7 ½ percent of the estimated cost of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.
8. Period for payment of Running Bill	Three weeks from the date of submission of each Running account bills by the Contractor.

9. Period for submitting the final Bill	One month from the date of virtual completion of the work by the Contractor.

10. REFERENCES

EARTH WORK - IS CODES		
1	IS-1200 (Part 1)	Method of measurement of building and Civil Engineering Works.
2	IS 1200 (Part 1)	Method of measurement of earth work
3	IS 1200 (Part-27)	Method of measurement of earth work (by Mechanical Appliances)
4	IS 4988 (Part IV)	Excavators
5	IS 12138	Earth moving Equipment's
6	IS 3764	Safety code for excavation work
7	IS 4082	Recommendations of stacking and storage of construction materials at site
CONCRETE WORK - IS CODES		
1	IS 383	Specification for coarse and fine aggregate from natural sources for Concrete.
2	IS 456	Plain and reinforced concrete - Code of practice
3	IS 516	Method of test for strength of concrete
4	IS 1199	Method of sampling and analysis of concrete
5	IS 1200 (Part II)	Method of measurement of building and civil engineering work (concrete work)
6	IS 2386	Method of test for aggregates for concrete Part I to Part V
7	IS 4656	Specification for form vibrators for concrete.
8	IS 456	Code of Practices for plain and Reinforced concrete.
9	IS 516	Method of test for strength of concrete.
10	IS 1200 (Part II)	Method of measurement of building and civil engineering work – concrete work
11	IS 1791	Specification for batch type concrete mixes
12	IS 4925	Batch plants specification for concrete batching and mixing plant
13	IS 4926	Ready – Mixed Concrete
14	IS 10262	Recommended guidelines for concrete mix design
15	IS 13311 (Part I)	Indian standard for non-destructive testing of concrete. Method of test for ultrasonic pulse velocity
16	IS 13311	Indian standard for non-destructive testing of concrete. Method of testing by rebound hammer.
STRUCTURAL STEEL WORK - IS CODES		
1	IS 226	Structural steel (Standard quality)
2	IS 800	Code of Practice for use of structural steel in general building construction.
3	IS 801	Code of practice for use of cold formed light gauge steel structural member's in general building construction.

4	IS 806	Code of Practice for use of steel tubes in general building construction.
5	IS 808	Dimension for hot rolled steel sections.
6	IS 813	Scheme of symbols for welding.
7	IS 814	Covered electrodes for metal arc welding of (Part I & II) structural steel.
8	IS 816	Code of practice for use of metal arc welding and general construction in mild steel.
9	IS 822	Code of Practice for inspection of welds.
10	IS 961	Structural steel (high tensile)
11	IS 1120	Coach Screws.
12	IS 1149	Specification for light tensile steel rivet, bars for structural purposes.
13	IS 1161	Steel tubes for structural purposes.
14	IS 1182	Recommended practice for Radiograph examination of fusion welded butt joints in steel plates.
15	IS 1200	Method of measurement in Building Civil Engineering work.
16	IS 1239	Mild steel tubes, tubulars and other wrought steel fittings
17	Part I	Mild Steel
18	Part II	Mild steel tubulars and other wrought sheet pipe fittings.
19	IS 1363	Black hexagonal bolts, nut and black hexagon screws product of Grade C (size range M25 to M64) (Part 1 to 3).
20	IS 1365	Slotted counter sunk screws.
21	IS 1367	Technical supply conditions for threaded fasteners.
22	IS 1977	Structural steel (ordinary quality)
23	IS 2016	Plain washer.
24	IS 2062	Structural steel (fusion welding quality)
25	IS 2595	Code of practice for Radiographic testing.
26	IS 4000	High strength bolts in steel structures Code of practice.
27	IS 4923	Hollow steel sections for structural use.
28	IS 5624	Specification for foundation bolts.
29	IS 6227	Code of practice for use of metal arc welding in tubular structure.
30	IS 7215	Tolerances for fabrication of steel structures.
GI SHEET FIXING		
1	IS 277	Galvanised steel sheets (plain and corrugated)
2	IS 1367 (PT - 13)	Technical supply conditions for threaded steel fasteners pt.13 hot dip galvanized coating on threaded fasteners
3	IS 1200 (PT.IX)	Method of measurements of building and civil engineering works Part - 9 Roof covering (including cladding)
DEMOLISHING WORK		
1.	IS 1200 (Pt - XVIII)	Method of Measurements of Building and Civil Engineering Works (Part -XVIII) Demolition and Dismantling
2.	IS 4130	Demolition of Buildings-

HVAC WORK - IS CODES	
IS:659–1964 (Reaffirmed1991)	Safety Code for Air Conditioning.
IS:660–1963 (Reaffirmed1991)	Safety code for Mechanical Refrigeration
IS : 3016	Code of Practice for Fire Precautions in Welding and Cutting operations
IS : 818	Code of practice for Safety and Health Requirements in Electrical & Gas Welding and cutting operations.
IS:5216–1982 (Part-I) (Reaffirmed 1990)	Guide for safety procedures and Practices in Electrical work
IS:3696	Safety Code for Scaffolds and Ladders
IS 3615	Glossary of terms used in refrigeration and air conditioning
IS-3624	Bourdon tube pressure and vacuum gauge.
IS 732	Code of practice for electrical wiring and fittings for buildings.
IS 659	Air conditioning safety code
IS 660	Mechanical refrigeration safety code.
IS 325	Three phase induction motor.
IS-2074	Ready mixed paints.
IS 1554 (Part-I)	PVC insulated (heavy duty) electrical cables for working voltages upto and including 1100 V.
IS 1239	Mild steel tubes, tubular and other (Part I&II) wrought steel fitting.
IS 3589	Electrically welded steel tube for water, gas and sewage.
IS-996	Single phase, small AC universal motors.
IS-1367	Technical supply conditions for threaded steel fasteners.
IS-6392	Steel pipe flanges.
IS-778	Gun metal gate, globe and check valves for general purpose.
IS 4671	Expanded polystyrene for thermal insulation (if applicable)
IS 7240	Code of practice for Industrial application and finishing of thermal insulating material at temperature from - 80° C to 40°C. (if applicable)
IS 277	Galvanised sheet steel.

IS 655	Metal air ducts

ABBREVIATIONS:

The following abbreviations wherever they appear in the specifications, shall have the meaning or implication hereby assigned to them:

Mm	Millimetre
Cm	Centimetre
M	Metre
Km	Kilometre
Mm /sqmm 2	Square Millimetre
Cm /sqcm 2	Square centimetre
Dm /sqdm 2	Square decimetre
M /sqm 2	Square metre
Cm / cubic cm 3	Cubic centimetre
Dm / cubic dm 3	Cubic decimetre
M3/cum 3	Cubic metre
Ml	Millilitre
Kl	Kilolitre
Gm	Gram
Kg	Kilogram
Q	Quintal
T	Tonne
Fps system	Foot pound second system
°C	Degree Celsius temperature
Fig	Figure
Re/Rs	Rupee/ Rupees
No	Number
Dia	Diameter
AC	Asbestos cement
CI	Cast Iron
GC	Galvanised corrugated
GP	Galvanised plain
GI	Galvanised iron
PVC	Polyvinyl chloride
RCC	Reinforced cement concrete
SW	Stone ware
SWG	Standard wire Gauge

11. TECHNICAL SPECIFICATION

The work shall be carried out as per latest CPWD/KPWD Specifications as amended from time to time and relevant IS codes. In case of discrepancy between technical specification and BOQ, the BOQ prevails.

TECHNICAL SPECIFICATIONS FOR HVAC WORK

1.0 Equipment

1.1 Variable Refrigerant Flow Packages

1.1.1 Scope

The scope of this section comprises of supply, installation, testing and commissioning of self-contained air cooled duct type variable refrigerant flow packages each comprising of an outdoor and multiple indoor ductable units conforming to these specifications and in accordance with the requirement of drawings and schedule of quantities.

1.1.2 Outdoor Unit

Outdoor unit shall be factory assembled, good for outdoor installation, constructed out of heavy gauge MS panels with weather proof painting. The units shall be factory wired with necessary controls duly tested prior to dispatch conforming to the following specifications.

(a) All outdoor units shall consist of minimum two scroll compressors, preferably one with inverter drive, capable to operate even when one compressor is unserviceable.
(b) Outdoor units above 16 HP shall consist of minimum two separate inverter driven compressors.
(c) The units shall be provided with duty cycling arrangement for multiple inverter compressors.
(d) The outdoor unit shall be modular in design to facilitate installation one after another close to each other. Preference would be given to compact units having smaller footprint.
(e) Outdoor units should be rugged of anti-corrosion design.
(f) The outdoor unit shall comprise of sub cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping.
(g) The condensing unit shall be provided with state-of-the-art microprocessor based control panel.

The outdoor unit shall be provided with Aero spiral design fan exhibiting low noise level characteristics complete with aero fitting grille to facilitate spiral discharge of airflow to effect reduction in pressure losses. The fan should be capable to respond to external static pressure of 5mm. The condensing unit shall be designed to facilitate fail safe operation when connected to multiple indoor units. Following safety devices shall be integral part of the outdoor unit:

- High pressure switch
- Fan drive over load protection switch
- Fusible plug

Over load relay including overload protection for inverter driven compressor.

1.1.2.1 Condenser

Condenser shall be air-cooled type, suitable for outdoor installation and shall be suitable for operating at 46 deg C db and 24 deg C wb temperatures. Condenser shall be in copper tube. Condenser coil shall be of minimum 4 rows deep and the fin spacing shall not exceed 2mm. The maximum face velocity a cross the coil shall not exceed 215 MPM. The condenser frame shall be constructed from heavy duty galvanized steel.

The condenser fan/s shall be of propeller type with 900 RPM variable voltage electric motor complete with IP-55 protection. Motor shall be speed controlled to ensure a stable operation for varying ambient, by a factory fitted direct acting head pressure activated variable speed drive. The condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessories necessary with the equipment supplied.

1.1.3 Anti-Corrosion Protective Treatment Associated with Condensing Units, Piping, Joints and U bends & Refrigerant Piping between Outdoor and Indoor Units.

All inter connecting piping, joints and U bends within the condensing unit shall be painted with two coats of clear transparent polymer coating for protection against corrosion from ambient air pollution. Two coats of protective coating shall be applied. Each coat shall have dry film thickness of 35 micron or more.

The coating shall be strong, flexible and durable. It shall have good adhesive and abrasion resistance. It shall be resistant to moisture, UV, acid, alkali and other chemicals and capable of functioning between -250 C and 1500 C.

The polymer shall be obtained by the mixing of base / monomer with a hardener/poly merizor. It may brush applied or with the use of a suitable gun.

The scope of this work comprises the supply, erection testing and commissioning of air-cooled type DC Inverter Based Variable Refrigerant Flow (VRV/VRF) / Variable Refrigerant Volume (VRV) type air conditioning system conforming to the specifications listed below for air-conditioning different areas (as specified) inside the Building.

Type

Units should be DC Inverter /Twin Rotary Technology based Variable Frequency Driven VRF/VRV air- conditioners with air-cooled outdoor units, which shall be capable of cooling and heating gas as per individual or season requirement suitable for operation on 415V, 3 phase, 50 Hz AC electric supply (as given in technical specification). The outdoor units shall have cooling mode, consisting of one / multiple modules with single/Multi circuit(SET) of refrigerant piping and multiple indoor units of various types and capacities. Each indoor unit should have capability to cool independently for the requirement of particular area and also as per seasonal weather changes. The indoor unit on any circuit can be different type and capacity and shall be controlled individually.

General

Indoor units and outdoor units shall be factory assembled, tested and filled with first charge of R410A refrigerant only before delivering at site. Indoor units should be suitable for operation on 210-240V 1phase 50hz AC & Out door units of high capacity above 5.5hp shall be suitable for operation on 380V – 415V, 3 phase, 50 Hz AC electric supply. Units should be air cooled type, DC Inverter Technology based variable frequency driven VRF type air conditioner consisting of outdoor units and multiple indoor units, each suitable to cool in summer and heat in winter as per the requirements. All proposed outdoor unit should have minimum COP of 3.65 and 4.8 at 100% and 50% load condition respectively for cooling.

The DC inverter / Twin rotary technology based variable frequency driven modular type VRF equipment should be capable enough, so that the refrigerant piping between indoor and outdoor unit shall be extendable up to 100m with maximum height difference between outdoor and indoor unit of 80m or more and level difference between two indoor unit up to 25m or more.

Outdoor Unit

The outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing constructed form rust proofed mild steel panels coated with a baked enamel finish. The unit should be completely factory wired tested with all necessary controls. It should be Air Cooled type with Top Air discharge.

Compressor

1. All outdoor units must have Twin Rotary inverter compressors.
2. It should also be provided with duty cycling for DC inverter compressors capable of changing the rotating speed of compressor by DC inverter controller to follow variation in cooling loads and switching staring sequence for better stability and prolonging equipment life.
3. Each outdoor unit shall be equipped with 100% inverter type variable speed compressor for better efficiency of the system.
4. All outdoor unit must have pump out and pump down feature so that in case of failure, refrigerant can be accommodated in indoor and outdoor unit respectively.
5. The Modular type outdoor unit shall be allowed for side-by-side installation.
6. Each unit shall be provided with its own microprocessor control panel.
7. All outdoor unit must have Anti Corrosive Fins in Condenser for better life.
8. All outdoor unit should have Oil recovery system.
9. Outdoor unit should have connectable range of indoor units from 0.59 TR to 8 TR and above.
10. Outdoor unit shall be suitable for mix match connection of all type of indoor units.
11. The condensing unit shall be designed to operate safely when connected to multiple FCUs.

Compressor

Each outdoor unit shall be equipped with 100% inverter variable speed compressor for better efficiency of the system. The unit shall have preferably minimum 2

compressors –fully inverter type in each unit. The ODU system shall be of modular type capable of integration.

Heat Exchanger

The heat exchanger shall be constructed with copper tubes mechanically bonded to copper/ aluminum fins to form a cross fin coil. The fins shall be covered by anti-corrosion resin film.

Refrigerant Circuit

The refrigerant circuit shall include an accumulator, liquid and gas shut off valves and a solenoid valves.

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

Safety Devices

The following safety devices shall be part of the outdoor unit; High Pressure Switch, Low Pressure Switch, Fan Motor Safety Thermostat, Inverter Overload Protector, Over Current Relay, Over voltage Relay, Under voltage Relay, Fusible Plugs, Fuses.

Oil Recovery System

Each unit shall be equipped, with an oil separator to ensure stable operation with long refrigerant piping.

Indoor Unit

The indoor unit shall be Ceiling / Wall Mounted type or other as specified in BOQ. These units should be suitable for operation on 220V – 240V, Single Phase, 50 Hz AC electric supply. These units shall have electronic control valves to control refrigerant flow rate in response to load variation in the room.

The address of IDU shall be set automatically in case of individual and group control. The IDU shall be basically a fan coil unit suitable for Ceiling / Wall hung type. Each unit shall have Cooling Coil, Blower, Filter, BLDC Motor, Drain pan and accessories. All the IDUs installed to have individual Cordless Remote controls.
Indoor unit shall have cleanable type filter to an integrally molded plastic frame. The filter shall be slide away type and neatly inserted. It shall be possible to clean the filters either with compressed air or water. The Cooling coil shall have copper tubes with Aluminum fins . The Fan section shall be dual suction, aerodynamically designed and balanced turbo, multi blade type blower to ensure low noise and vibration free operation and having multiple speed motor. The fan shall be direct driven type, mounted directly on motor shaft having support from housing.

Accessories

The following accessories may be required at air handling units, the detailed specifications are given in individual sections, and quantities separately described in the schedule of quantities.

a. Thermostatic expansion valves for each 3 row coil set.
b. Cooling/heating thermostats as per section "Automatic Controls and Instruments" shall be located in return air stream.

c. Condensate drain piping upto sump or floor drain in air handling unit rooms as described in section "Piping".
d. Vibration isolation pads for mounting of Air Handling Units on PCCb locks (225 x 225 x 225 PCC blocks shall be provided by other agencies)

Performance Data

Air handling units shall be selected for the lowest operating noise level. Technical submittal of air handling units shall be prepared for Consultants approval prior to procurement as mentioned under clause 7 under Special Conditions. Fan performance rating and power consumption characteristics shall be submitted and verified at the time of testing and commissioning of the entire installation.

Testing

Cooling/heating capacity of various air handling unit models shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Air flow measurements shall be carried out by an anemometer and temperature measurements by accurately calibrated thermometers. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

1.2 Refrigerant Piping (VRV/VRF)

The copper refrigerant piping shall be carried out neatly to connect outdoor and group of indoor units and shall run along with wires/cables. The refrigerant piping shall be carried out using hard drawn copper pipes & readymade copper fittings for pipe diameter exceeding 19mm. Piping less than 19mm shall be carried out using soft seamless copper pipes. Joints shall be affected by soldering/brazing process using silver rods. Suitable sleeves shall be provided at all wall crossings as required. The refrigerant circuit shall include liquid line and gas shut-off valves besides solenoid valve at the end of condenser. The refrigerant piping shall be carefully sized with necessary headers and should consistof accessories including Y-joints.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 21Kg/ Sqcm. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum equivalent to700mm Hg and held for another 24hours prior to commencement of gas charging.

All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building element by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

The liquid and suction refrigerant lines including all fittings, valves, strainer etc. shall be insulated with 13 mm thick closed cell elastomeric insulation material preferably in tubing form as specified in Schedule of Quantities.

To protect nitrile rubber insulation associated with exposed copper piping from degrading due to ultra violet rays & atmospheric conditions, it shall be covered with poly shield coating. Fiber glass tape shall be helically wrapped & applied with two coats of resin with hardener to give smooth finish.

The recommended wall thickness of copper pipes being used for VRV/VRF application using high pressure refrigerant, R 410 A, is as under:

Copper Pipe Outer dia (mm)	**Coppertubewallthickness(mm)**
	Minimumrequirement
Dia6.4	0.8
Dia9.5	0.8
Dia12.7	0.8
Dia15.9	1
Dia19.1	0.8
Dia22.2	0.8
Dia25.4	0.88
Dia28.6	0.99
Dia31.8	1.10
Dia34.9	1.21
Dia38.1	1.32
Dia41.3	1.43
Dia 54	1.55

1.3 Centralized Remote Controller, Touch Screen Type

A multifunctional compact centralized controller shall be provided with the system.

The Graphic Controller must act as an advanced air conditioning management system to facilitate complete control of VRV/VRF air conditioning equipment, It should be user friendly through its touch screen, icon display and color LCD display.

It shall be able to control upto several groups of indoor units with the following functions: Starting/stopping of Air Conditoners as a zone or group or individual unit.

Temperature setting for each indoor unit or zone.

Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.

Monitoring of operation status such as operation mode & temperature setting of individual indoor unit, maintenance information and troubleshooting I nformation.

Display of air conditioner operation history.

Daily management automatic on through early schedule function with possibility of various schedules.

The controller shall comprise of wide screen user friendly color LCD display and can be wired by a non-polar 2 wire transmission cable upto a distance of 1 km away from indoor unit.

Unified On/Off Controller

Unified ON/OFF controller shall be supplied as optional accessory.

The controller shall be able to control minimum15 groups, each group containing maximum 16 indoor units or 128 indoor units with the following functions:
On/Off as a zone or individual unit. Indication of operation condition of each group. Select one of 4 operation modes.

Schedule Timer

A schedule timer shall be supplied as an optional accessory.
The timer shall be able to set operation schedule for all indoor units.
The timer shall be able to set 8 patterns of schedule combined with centralized controller.

Testing

All the fans shall be tested for performance and the following test results shall be furnished:

a. Air flow rate in CFM.
b. Static pressure at the fan supply end.

Painting

On completion of the erection and testing, the outside of the fans shall be painted with two coats of Synthetic Enamel paint of approved color over and under coat of primer.

Inline Fans

Inline fan shall incorporate approved make SISW direct driven Centrifugal Fan with TEFC motor with IP-44 protection. The fan assembly shall be encased in a sheet metal housing of 22gauge GSS and with necessary inspection cover with proper gasket assembly. The fan material shall be galvanized sheet steel. Flanges shall be provided on both sides of the Inline fan to facility ate easy connection. Flexible anti-vibration joints shall be provided to arrest vibration being communicated to other equipment connected to the Inline fan. Motor shall be single phase/three phase as per required duty conditions.

All single phase fans shall be provided with speed regulator while all three phase fans shall be provided with opposed blade damper in GSS construction at fan outlet for air balancing.

All inline fans shall be internally lined with 15mm thick open cell nitrile rubber insulation to achieve noise level of 40 db.

Synthetic Fiber Filters (EU-3)

Synthetic fiber filter shall be constructed out of 50mm deep non-woven synthetic fiber replaceable media secured with anodized ductile aluminum mesh on one side & 40 sieve HDPE mesh on the other side. All the layers to be dully stitched together & to be housed in 18G Aluminum anodized frame. The filter element shall have 11 folds/Rft. The filter shall have an efficiency of 90% down to 10 microns when tested as per BS:2831standard. It shall be suitable for operation under 100% Relative Humidity & 120 degree C temperature conditions. The velocity over the face of filter shall not exceed 105 MPM and the pressure drop across the filter shall not exceed 3 mm WG for 50mm thick filter. The filter frame shall be suitable for mounting in air handling unit as required at site.

Minimum Efficiency Reporting Value Parameters (MERV-13)

ASHRAE Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, Percentage in Size Range		
	Range10.30–1.0	Range21.0–3.0	Range33.0-10.0
1.	N/A	N/A	E3<20
2.	N/A	N/A	E3<20
3.	N/A	N/A	E3<20
4.	N/A	N/A	E3<20
5.	N/A	N/A	20<E3 <35
6.	N/A	N/A	35<E3 <50
7.	N/A	N/A	70 <E3
8.	N/A	E2<50	85 <E3
9.	N/A	50<E2 <65	85 <E3
10.	N/A	65<E2 <80	85 <E3
11.	N/A	80 <E2	85 <E3
12.	E1<75	90 <E2	90 <E3
13.	75<E1 <85	90 <E2	90 <E3
14.	85<E1 <95	90 <E2	90 <E3
15.	95 <E1	95 <E2	90 <E3

Micro vee Filters:(EU-7)

Fine filters shall be designed to remove particles down to 3 microns as per BS:6540 standard.

Filter shall comprise of aluminum sheet duly anodized. Filter element shall be made out of non-woven synthetic supported by anodized ductile aluminum mesh on one side & HDPE mesh not less than 40 sieve size on the other side with 11 folds/Rft of filtration area. All the layers to be dully stitched together. All sides to be sealed with ductile epoxy resin and filters shall be cleanable type using water/detergent. Rubber gaskets to be provided on the flange. Filter element shall be specially treated with antifungal and bacterial reagent to prevent growth of micro-organisms shall be screwed into the frame by means of an aluminum clamp Patti and brass screws. They shall comprise of housing made from MS angles/flats epoxy coated of size suitable to receive the required number of filters to handle specified Cfm for each AHU. All filters shall be installed in same plane. No zig zagging shall be allowed by means of threaded bolt

Unit Base & Casing

Base panel shall be constructed out of fabricated steel structure of adequate size. Casing panels shall be of 1.2 mm thick, welded construction, removable type to provide easy access to equipment and shall be bonderized and painted. Casing shall be complete with discharge outlets, grilles, space for refrigeration equipment, fans, condenser coil etc.

Rotary Compressor

The rotary compressor shall be an industrial quality rugged, cast iron, hermatic / semi hermatic compressor with capacity control side valve, oil sump heater & differential pressure refrigerant oil flow system. The compressor shall be provided with multiple pressure lubricated rolling element bearing group shall support the rotating assembly. Suitable overload protection shall be provided & necessary isolating valves shall be provided at suction & discharge. The compressor shall be fitted with electrically operated oil heaters with built in thermostats. The heaters shall be shall be automatically actuated when the compressor is stopped. Necessary time delay shall be provided for restart of compressor. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

Condenser

Condenser shall be air cooled in copper tube & aluminium fins construction. Condensers shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessory necessary with the equipment supplied.

Condenser Fan

Fan shall be preferably propeller type suitable for fractional horse power drive with IP-55 protection.

Cooling Coil

Cooling coil shall be of the fin and tube type, having aluminium fins, firmly bonded to seamless copper tubes. Face and surface areas shall be such as to assure rated capacity and the air velocity across the coil shall not exceed 170 MPM. The coil shall be factory tested under water at 21 Kg/ Sq cm air pressure.

Fan Section

The fan associated with non Ductable indoor units shall be dual suction, aero dynamically designed, multi blade type, statically-dynamically balanced to ensure smooth circulation of air exhibiting lower noise level. The fan shall be direct driven type mounted directly on motor shaft supported from the housing.

Fan associated with Ductable indoor unit shall be centrifugal double inlet double width forward curved type, preferably with variable pitch pulleys. The fan housing shall be statically-dynamically balanced at works to ensure noise and vibration free operation.

Filters

Filters shall be cleanable, synthetic fiber media of approved make. Velocity through filters shall not exceed 105 MPM and pressure drop across filters shall not exceed 5 mm of WG.

Insulation

All indoor unit shall be factory insulated with minimum 9 mm thick closed cell elastomeric insulation material towards thermal/acoustic treatment.

Drain pan shall be insulated with minimum 9mm thick closed cell elastomeric insulation material. Fixing of coil section and drain pan shall be done in such a way to avoid direct metal contact with any other un-insulated metal part in order to avoid condensation.

Condensate drain piping around the indoor unit shall also be insulated with minimum 9mm thick closed cell elastomeric insulation preferably in tubing form.

Refrigerant Piping (For Split Units)

The copper refrigerant piping shall be carried out neatly to connect outdoor and indoor unit/s and shall run along with wires/cables. The refrigerant piping associated with Ductable units shall be carried out using hard drawn copper pipes & ready made copper fittings for pipe diameter exceeding 19mm. Piping less than 19mm shall be carried out using soft seamless copper pipes. Joints shall be affected by soldering/brazing process using silver rods. Suitable sleeves shall be provided at all wall crossings as required. The refrigerant circuit shall include liquid line and gas shut-off valves at the end of condenser.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 21Kg/ Sqcm. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum equivalent to 700 mm Hg and held for another 24 hours prior to commencement of gas charging.

All refrigerant pipes shall be properly supported and anchored to the buildings structure using steel hangers, anchors, brackets and supports which shall be fixed to the building element by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

The liquid and suction refrigerant lines including all fittings, valves, strainer etc. shall be insulated with 13 mm thick closed cell elastomeric insulation material preferably in tubing form as specified in Schedule of Quantities.

To protect nitrile rubber insulation associated with exposed copper piping from degrading due to ultra violet rays & atmospheric conditions, it shall be covered with poly shield coating. Fiber glass tape shall be helically wrapped & applied with two coats of resin with hardener to give smooth finish.

Air Distribution

Scope

The scope of this section comprises of supply, fabrication, installation and testing of all sheet metal ducts and supply, installation, testing and balancing of grilles, registers and diffusers, in accordance with these specifications and the general arrangements shown on various drawings.

Duct Material

The ducts shall be fabricated from galvanized steel sheets class VIII conforming to ISS:277, 1962 (revised) or aluminium sheets conforming to ISS:737-1955, wherever aluminium ducts are specified.

All ducts shall be fabricated from galvanized steel sheets and all ductwork shall conform to SMACNA Standard.

Galvanized sheet shall possess light coating of Zinc, generally 120gm/sum of surface area. GI sheets shall be of Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by Owner's site representative shall be subject to approval and tested for thickness and zinc coating at Contractor's expense.

Duct Fabrication

All ducts shall be fabricated and installed in a workman like manner, generally conforming to SMACNA Standards. Round exposed ducts shall be die formed for achieving perfect circle configuration. The plain end of the round duct shall be slipped into the mating round duct with machine pressed flared end and there after pop riveted to complete the joint. The sample of round duct shall be displayed at the site prior to procurement for the approval of Consultants and Architects.

a. Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.
b. All exposed ducts within conditioned spaces shall have only slip joint sand no flanged joints. The internal ends of slip joints shall be made in the direction of air flow.
c. Change in dimensions and shape of ducts shall be gradual. Curved elbows, unless otherwise approved, shall have a center line radius equal to one and half times the width of the duct. Air turns shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes, arranged to permit the air to make the turns without appreciable turbulence. GI splitter dampers complete with brass metal lever shall be installed at each bifurcation / trifurcation point of duct for proper flow of air quantity in each duct.
d. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.
e. All sheet metal connections, partition sand plenums required to confine the flow of air to and through the filters and fans, shall be constructed out of 18 gauge galvanized steel sheet, thoroughly stiffened with 25mm x 25mm x 3mm angle iron braces and fitted with all necessary doors as required by the Consultants to give access to all parts of the apparatus. Doors shall not be less than 450mm x 450mm in size. All hardware fittings such as thunder bolts, hinges, handles etc shall be in extruded aluminium construction.
f. **In case of grid type false ceiling, the entire diffuser assembly with plenum shall be independently hung from the ceiling through adjustable GI wires and the same shall be connected to the main duct through a flexible round duct.**

All ducts shall be fabricated from galvanized steel /aluminium sheets of the following thickness as indicated below:

TABLE-I

Standard with no intermediate bracing

Rectangular Ducts (GSS)	**Pressure250Pa**			**Pressure500Pa**		
	Duct Section Length1.2 m(4 ft)			**Duct Section Length1.2m(4 ft)**		
Maximum Duct Size (mm)	Gauge	JointType	Bracing Spacing	Gauge	Joint Type	Bracing Spacing
1-550	26	C&SS	Nil	26	C&SS	Nil
551-750	26	C&SS	Nil	26	TDC/TDF/Slipon	Nil
751-900	26	TDC/TDF/Slipon	Nil	24	TDC/TDF/Slipon	Nil
901-1200	24	TDC/TDF/Slipon	Nil	22	TDC/TDF/Slipon	Nil
1201-1300	22	TDC/TDF/Slipon	Nil	20	TDC/TDF/Slipon	Nil
1301-1500	22	TDC/TDF/Slipon	Nil	20	TDC/TDF/Slipon	Nil
1501-1800	22	TDC/TDF/Slipon	Nil	18	TDC/TDF/Slipon	Nil
1801-2100	20	TDC/TDF/Slipon	Nil			
2101-2250	18	TDC/TDF/Slipon	Nil			
2251-2400	18	TDC/TDF/Slipon	Nil			
2401-2700	18	TDC/TDF/Slipon	Nil			

Abbreviations:
C"-cleat
S"–Scleat
a..SS – Standing Scleat.
For Aluminium duct material should be one commercial gauge higher with 22 Gas minimum.

Fabrication Standards & Equipment

All duct construction and installation shall be in accordance with SMACNA standard. In addition, the ducts shall be factory fabricated with the help of following machines to produce the requisite quality of duct work.

1. Coil (sheet metal in roll form) lines to facilitate location of longitudinal seams at corners/folded edges only, for required duct rigidity and leakage free characteristics. No longitudinal seams permitted along any face side of the duct.
2. All ducts, transformation piece, and fittings to be made on CNC

profile cutter for requisite accuracy of dimensions, location and dimensions of notches at the folding lines.

3. All edges to be machine treated using lock formers, flanges and rollers for turning up edges.

Duct Construction

All ducts shall be fabricated and installed in work man like manner, conforming to relevant SMACNA codes.

a.) Ducts so identified on the Drawing shall be acoustically lined and insulated from outside as described in the section "Insulation" and as indicated in schedule of quantities. Duct dimensions shown on drawings, are overall sheet metal dimensions inclusive of acoustic lining where required and indicated in Schedule of quantities. The fabricated duct dimensions should be as per approved drawings and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gapes.

b.) Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or Snap button as per SMACNA practice to ensure air tightness.

c.) All ducts up to 750 mm width within conditioned spaces have slip and drive (C & S/SS) joints. The internal ends of slip joints shall be in the direction of airflow. Care should be taken to ensure that S/SS Cleats are mounted on the longer side of the duct and Cleats on the shorter side. Ducts and accessories including insulation within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint unless and otherwise specified.

d.) All ducts over 750 mm duct size for pressure class 1 ' / 250 Pa (W.G.), and over 550 mm duct size for pressure class 2" / 500 Pa(W.G.) shall have transverse joints as specified in Annexure I.

e.) Changes in dimensions and shapes of ducts shall be gradual (between 1:4 and 1:7), Air –turns (vanes) shall be installed in all bands and duct collars designed to permit the air to make the turn without appreciated turbulence.

f.) Ducts shall be fabricated as per details on Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seam, tees, or angels of amplesize to keep the ducts true to shape and to prevent buckling, vibration or breaking.

g.) All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans shall be constructed of 18 gauge GSS/ 16 gauge aluminium thoroughly stiffened with 25mm x 25mmx3mm galvanized steel angle braces and fitted with all necessary inspection doors as required to give access to all parts of the apparatus access doors shall be not less than 45cm x 45 cm in size.

h.) Plenums shall be shop/factory fabricated panel type and assembled at

site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i,e. towards GS sheet and riveting shall be done from outside.

i.) Self-adhesive Neoprene rubber/ UV resistant PVC liningof 5mm thickness instead of felt shall be used between mating flanges and duct supports for all ducting installation.

j.) Towards fire protection, all kitchen extract ductwork shall be fabricated out of 18 gauge GSS and coated with approve dfireretardant paint preferably spray edatfactory prior to dispatch in order to capture the flanges, corners and internal joints.

Duct Installation

All ducts shall be installed generally as per the drawings and in strict accordance with approved for construction shop drawings prepared by the contractor.

a. The contractor shall provide and neatly erect all sheet metal work as may be required to carryout the intent of these specifications and drawings. This work shall meet with the approval of the Architect/ Consultants in all its parts and details.

b. All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the buildings, whether or not the same are shown on the drawings. Where it becomes necessary to avoid beams or other structural work, plumbing or other pipes, and or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained as approved or directed by the Architect / Consultants.

c. If a duct cannot be run as shown on the drawing, the contractor shall install the duct between the required points by any path available, subject to the approval of the Architect / Consultants.

d. All duct work shall be independently supported from building elements or as required by the Architect / Consultants. All horizontal ducts shall be rigidly and securely supported, in an approved manner, within hangers formed of wire rope suspension arrangement with hot dipped galvanized (HDG) perforated channel under the ducts. The distance between two successive supports shall not be greater than 2 meter center to center. All vertical duct work shall be supported by structural members at each floor.

e. Ducting on top of the ceiling shall be supported from the slab above, or from beams with the help of adequate strength dash fasteners, after obtaining approval of the Architect/Consultant. In no case shall a duct be supported from the ceiling hangers or be permitted to rest on a hung ceiling.

f. All metal work in dead or closed down spaces shall be erected in time to occasion no delay to other contractors in the building.

g. All ducts shall be totally free from vibration under all conditions of operations. Whenever duct work is connected to fans, that may cause

vibrations in the duct, ducts shall be provided with two flexible connections located close to the unit in mutually perpendicular directions. Flexible connection shall be constructed of fire resistant flexible double canvas sleeves at least 100mm deep, secured properly and bolted at both ends. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

h. The two mating flanges of the ducts being joined with each other shall be made air tight by providing 2mm thick foam rubber insertion fixed on both mating flanges by means of good quality adhesive. Rubber strip shall also be provided between bottom surface of duct and angle iron at each duct support to avoid metal to metal contact.

Volume Control Dampers

a. All dampers shall be multiblade type of robust construction of galvanized steel and tightly fitted. The design, method of handling, and control shall be suitable for the location and service required.

b. Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation control or setting devices shall be made robust, easily operable and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

c. Dampers shall be placed in ducts and at each supply air collar, whether or not indicated on the drawings, for the proper volume control and balancing of the system.

Fire Cum Smoke Dampers

Bare Dampers

a. Fire damper blades and outer frame shall be formed out of 1.6mm (16G) galvanized steel sheet of length as mentioned in the approved for construction shop drawings titled as AHU Room Blow Up. The damper blade shall be pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16 gauge galvanized sheet steel. For preventing smoke leakage, metallic compression side seals shall be provided. Dual side linkage shall be provided for better structural stability. The construction of the fire damper shall allow maximum free area to reduce pressure drop and noise in the air passage. In normal position damper blade shall be held in open position with the help of a 220 V operated electric actuators thereby providing maximum air passage without creating any noise or chatter.

b. For wall mounted fire dampers retaining MS angles duly painted with black enamel paint shall be supplied and installed by HVAC Contractor as per established installation procedure. Whereas the fire damper is also to be used for Smoke management (Smoke and fire damper) the same shall be as per UL-555 S-Class-II.

c. Every motorized fire damper/Smoke and fire damper shall be tested for in the factory and will be certified by the manufacturer in form of the test certificate.

d. Fire damper shall also be supplied with spring lock fusible link rated for 720C (UL stamped) to close fire damper in event of rise in duct temperature.

e. For fire dampers/ smoke fire dampers of size higher than one approved by certifying agency the damper shall be supplied in multiple units of size not exceeding the tested damper by CBRI. All the multiple units shall be housed in a common factory fitted sleeve.

f. The fire dampers shall be mounted in fire rated wall with a duct sleeve 400 mm/500 mm long depending upon the wall thickness. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of galvanized sheet shall be 18 gauge.

g. The damper shall be installed in accordance with the installation method recommended by the manufacturer.

Actuators

The actuator shall be maintenance free direct coupled spring return type suitable to work on 24 V electric supply. The torque rating of the actuator shall exceed at least by 15%over torque required to open/ close the damper. The selection of actuator size shall be the responsibility of the manufacture of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature. Other features of the damper actuator shall be as under:

h. Actuator shall have tamper proof housing with IP-54 protection rating.
i. Actuator shall have mechanical integrity of at least one hour at 9000 C.
j. Actuator shall have minimum 60000 safe position at rated torque. It shall be capable to withstand temperature of 750 C for 24 Hrs.
k. Actuator shall have electronic over load or digital sensing circuit to prevent damage to actuator.
l. Should be capable of changing direction of rotation by changing mounting orientation.
m. Actuator shall have manual over ride facility.

Damper actuator shall be such that it should close the damper in the event of power failure automatically & open in the same manner in case of power being restored.

Control Panel

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

n. Poweron lampswith 230V/ 24V Transformer.
o. Damper close and open indication.
p. Reset push button.
q. Push button for manual running of actuate or for periodic inspection.
r. Auxiliary contacts 24V& 230V.
s. Contact point store receive signal from smoked etector /fire alarm panel.

t. Additional terminal shall be provided to have signal (audio or visual) in central control room.

The control panel shall receive 230 V A/C supply & interconnecting wiring between control panel and actuator shall be carried out using fire proof cables. The Contractor shall ensure that all electrical connections are suitably terminated. The HVAC Contractor shall also check continuity of electrical circuit as recommended by the manufacture. Fire damper inspection door will be provided in AC duct to facilitate access to the system.

Supply Air Registers

Supply air registers shall be of approved make and of mild steel construction with individually adjustable bars. Supply air registers shall be double deflection type, with removable key-operated volume control dampers. The outer frame should be made out of 20 gauge and louvers of 24 gauge MS sheet.

a. All registers shall be selected in consultation with the Consultants. Different spaces shall require horizontal or vertical face bars and different width of margin frames.
b. All registers shall have a soft, continuous rubber gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers shall not be less than 80 percent.
c. Registers shall be adjustable pattern as such grille bar shall be pivot able to provide pattern with 0 to 100 degree horizontal arc and up to 30 degree deflection up or down. Bars shall hold deflection settings under all conditions of velocity and pressure.
d. Bars longer than 450 mm shall be reinforced by a set back vertical member.
e. Registers shall be given a rust inhibiting prime coat and factory applied enamel finish of approved color.

Plaque Diffuser

The Plaque diffusers shall be constructed out of Extruded Aluminium powder coated sections is designed to integrate with suspended ceiling arrangement preferably grid type.

The diffuser shall consist of a rear pan and a removable heavy gauge front flat panel attached to the rear pan through spring loaded locking posts. The flat panel may be removed whenever need arises to facilitate adjustment of the damper for air balancing.

The front panel shall be aerodynamic in appearance, rigid and preferably in single piece construction and free from any welding or forming blemishes.

The horizontal air discharge pattern shall be 360 0 type. Blank off baffles shall be provided to obtain one, two or three way blow pattern if specifically asked for in the “Schedule of Quantities”. Diffusers shall be provided with following accessories:

I. Opposed blade damper
II. Spiggot to facility at a round duct connection neck.

The performance criteria shall be in conformity with relevant ANSI/ASHRA E standards.

Swirl Diffuser

The diffuser face shall consist of fixed radically arranged air control blades. The supply air pattern shall permit specifically arranged internal air guidance elements or guide vanes. Such elements are not required for return/extract versions. Due to the rotary swirling motion of the air discharge, induction of room air occurs very quickly, resulting in decay of supply air velocity and temperature differential.

In order to stabilize horizontal discharge, all sizes must be mounted flushed with the suspended ceiling. The minimum height between floor & the diffuser face should be 2.6M or less. The face plate shall be square. The supply air versions shall be supplied with top/side entry spigot with lip seals and Volume Control Damper.

The diffuser face shall be fabricated out of 1.2 mm thick galvanized steel sheet, pretreated and powder coated white. The spigot shall also be of 1.2 mm thick galvanized steel sheet & lip seal of soft rubber.

The performance criteria shall be in conformity with relevant ANSI/ASHRA E standards.

Multislot Linear Diffuser

Linear ceiling diffuser shall be multislot type. The diffuser shall be fabricated out of extruded aluminium sections. Each slot shall be 19mm wide. Each slot shall be equipped with air flow direction control louver mechanically fixed. Integral sliding type hit & miss type volume control damper in extruded aluminium construction shall be provided for each slot for fine control of air flow in supply air portion only. The damper shall be fabricated out of anodized extruded aluminium sections. Other sections of ceiling diffuser shall be powder coated in color & shade approved by the Consultants/Architects. The linear diffuser shall be fixed in to a plenum chamber with concealed screws. Side end pieces or corner pieces shall be provided if required.

MultiLouvered Grills

For supply air double louvered grills in extruded aluminium construction shall be provided with individually adjusted louversa long with volume control damper in extruded aluminium construction. The louvers shall be pivoted in Nylon bushes for smooth operation foreturnair grilles similar to supply air as described above will be provided but without volume control dampers. These grilles shall be painted as per approved powder coated shade.

Linear Grilles

Linear Grilles shall be fabricated out of extruded aluminium sections. Flanges shall be of 1.3 mm thick extruded aluminium. Louvers shall be of extruded aluminium sections 3.7 mm thick at the front and 2.2 mm at the rear with15 degree deflection strong enough to with stand site abuse during installation. The sample of grille shall have to be got approved by the consultants before delivery. The linear grilles shall be provided with removable / fixed internal core.

All sections of linear grille shall be powder coated in color/shade approved by the Architects /Consultants.

The linear grilles shall be fixed into a plenum chamber having GI spacers with concealed screws. End pieces or corner pieces shall be provided as required.

Air Transfer Door Grille

Air transfer grilles in extruded aluminium construction shall be provided at the door of pantry and toilets wherever required. The air transfer grille shall be complete with matching rear flange. The grilles shall be anodized or powder coated in color and shade as approved by the Architects/Consultants.

Testing And Balancing

After completion of the installation of the complete air distribution system, all ducts shall be tested for air leaks.

Before painting the interiors, air distribution system shall be allowed to run continuously for 48 hours for driving away any dust or foreign material lodged within ducts during installation.

The entire air distribution system shall be balanced using approved anemometer. Air quantities at the fan discharge and at various outlets shall be identical to, or less than 5 percent in excess of, those specified and quoted. Leakage in each air distribution system shall be within 3 percent so that supply air volume at each fan shall be identical to, or no greater than 3 percent in excess of, the total air quantity measured at all supply outlets served by the fan. Branch duct adjustments shall be made by volume or splitter dampers. Dampers shall be permanently marked after air balancing is complete so that these can be restored to their correct position if disturbed at anytime. Complete air balance report shall be submitted to the Consultants for scrutiny and approval, and six copies of the approved report shall be provided with completion documents.

Insulation

All chilled water piping/refrigerant piping, chilled water equipment and Duct work shall be insulated in the manner specified here under:

Material

Chilled water pipes shall be insulated with closed cell elastomeric insulation of properties as given below:

Average Physical Properties Of Insulation						**Test Method**
Cell structure	Closed cell					--
Density (gm/cm3)	(0.04-0.07)					--
Thermal Conductivity (W/m.K)	Mean Temp.	-20°C	0° C	20°C	40°C	BS874, Part2 1986 DIN52612
	K. Value	0.034	0.035	0.037	0.039	--
Service Temperature Limit	(-40° Cto 105° C)					--

Water Vapour Permeability (ĩ)	Minimum 7,000	DIN52615
Water Absorption (%by volume)	1.5% Maximum	--
Ozone Resistance	Should be Excellent	--
Flamm ability	Class 1 followed by Class 0	BS - 476 Part 7 & Part 6

No insulation shall be applied on pipes until the pipes are satisfactorily tested, as specified in section "PIPING".

Application of Insulation

Cold insulation on pipes shall be applied as specified below:

u. Pipes shall be thoroughly cleaned with brush & linen and rendered free from all foreign matter and grease.
v. Apply SR–998 (or equivalent) adhesive on the bare surface of pipes.
w. Closed cell Elastomeric Thermal insulation preferably in tubing form shall be fixed tightly to the surface. All joints to be sealed properly with vapour barrier compound.

Condensate drain piping and refrigerant piping shall be insulated in the manner specified above.

All valves, fittings, strainers, etc in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and applied generally in the manner specified above, valves bonnets, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced. Exposed CHW pipe insulation shall be provided with necessary treatment as under:

a. Apply two layers of surface coating as under:
   I. Apply a coat of composition prepared out of synthetic resin, cristal line silica & ethyl alcohol.
   II. Cover the insulated surface with lagging in the form of fire retardant glass fibre cloth, by wrapping it on wet coating.
   III. Subsequently, apply a coat of special composition and allow drying.
   IV. Apply second coating there after achieving sufficient mechanical strength

Material

Insulation material shall be processed Elastomeric, nitrile rubber or other approved equal. Samples of insulation material shall be submitted for approval to the Consultants prior to procurement. The physical properties of material shall be as given here under:

Average Physical Properties Of Insulation						**Test Method**
Cell structure	Open cell					--
Density (Kg/CuM)	(140-180)					--
Thermal Conductivity (W/mK)	Mean Temp.	-20°C	0° C	20°C	40°C	DIN : EN12667
	K. Value	0.046	0.047	0.050	0.052	

Service Temperature Limit	(-20° Cto 105° C)	--
Ozone Resistance	Should be Excellent	--
Flammability	Class1	BS-476Part7-1997
Tensile Strength	190 K Pa	--
Resistance t o chemicals	Organic Solvents	Should be Excellent
	Dilute In organic acids	Should be good
	Mineral Oil	Should be good
Health aspects	Dust & Fibre free	--
Water Absorption	Non hygroscopic coating	

Application of Insulation

Acoustic lining of ducts wherever specified shall be applied as under:

x. Basic surface preparation using sandpaper.
y. Adhesive to be applied thereafter, preferably in the evening and be left for overnight.
z. Finally next morning Processed Nitrile rubber foam insulation to be applied & joints shall be sealed properly.

Duct Lining Scope :

The scope of this section comprises of supply and application of acoustic insulation conforming to following Specifications.

Duct Insulation

External thermal insulation of ducts shall be carried out with closed cell elastomeric insulation having thermal properties mentioned on first page of insulation sub head and thickness mentioned in schedule of quantities. The contractor shall ensure availability of all accessories as mentioned under appendices for achieving perfect workmanship. Insulation of ducts shall be applied strictly as per the recommendations of manufacturers amended from time to time. However, application procedure shall generally be as given hereunder:

a. Apply SR 998 / equivalent adhesive on the bare surface after vigorously cleaning the duct using fresh linen.
b. Closed cell elastomeric insulation material possessing class “O” properties in specified thickness to be fixed tightly to the surface with joints well butted.
c. Longitudinal as well as vertical joints shall be sealed with the adhesive forming proper bonding.

Circular ducts shall be insulated internally following procedure as mentioned above. In addition, insulated surface shall be secured with circular GI strips spaced at regular intervals. A sample of insulated duct shall be displayed at site and approval sought prior to application.

Thermal Insulation of ducts exposed to atmosphere:

Duct insulation shall be applied as follows:

a. Apply SR 998 / equivalent adhesive on the bare surface after vigorously cleaning the duct using fresh linen.
b. Closed cell elastomeric insulation material of class "O" properties in specified thickness to be fixed tightly to the surface with joints well butted.
c. Longitudinal as well as vertical joints shall be sealed with the adhesive forming proper bonding and taped over with same material.
d. Apply two layers of surface coating as under:
    I. Apply a coat of composition prepared out of synthetic resin, crystalline silica & ethyl alcohol.
    II. Cover the insulated surface with lagging in the form of fire retardant glass fibre cloth, by wrapping it on wet coating.
    III. Subsequently, apply a coat of special composition and allow drying.

Electrical Installation

The scope of this section comprises of supply, laying, testing and commissioning of electrical, wiring and earthing for all components of the HVAC system.

General

Work shall be carried out in accordance with the Specifications, local rules, Indian Electricity Act 1910 as amended upto date and rules issued there under, regulations of the Local Fire Insurance Association and Indian Standard code of practice No. IS : 732-1963 (revised) including Indian Electricity Rules 1956.

Wiring System

All power wiring shall be carried out with 650/1100 volts grade PVC insulated, aluminum/copper conductor cables as per "Schedule of Quantities", sized for starting current and continuous running current carrying capacity and by applying proper derating factor.

Selection of Cables / Wires

The size of cables and wires for individual connection to outgoing MCCB/SFU/I so lator shall be suitably rated. Above 100 Amps. solid links shall be used.

All power wiring shall be carried out with 650/1100 volt grade PVC insulated aluminium /copper conductor cables/wires sized for starting current and continuous rating of motors after applying derating factor as per the "Schedule of Quantities".

Cable Compartments

Cable compartment of minimum size of 400 x 400 mm or as shown in drawings shall be provided in the boards for termination of all incoming and outgoing cables entering from bottom or top. Adequate supports shall be provided in cable compartment to support cables. All incoming & outgoing switch terminal shall be brought out to the spring loaded terminal blocks in cable compartments and identified accordingly.

All the outgoing connections shall be brought on spring loaded (Elmex Type CSLT-1) terminals in the cable-alley. Minimum size of terminals for control and power wiring shall be 2.5 & 10 Sqmm respectively. No cable, however shall be terminated in to the switch/isolator/ MCCB/contactor/over load relay, under any circumstances.

Meters and Indications

All meters shall be housed in a separate compartment or as shown in design drawings and accessible from front only. Lockable doors shall be provided for the metering compartment. All switches, contactors, push buttons, push button stations, indicating lamps shall be distinctly marked with a small description of the service fed.

Painting

Entire sheet metal works shall undergo seven tank process including passivating, sprayed with a high corrosive resistant primer and baked in oven. The finishing treatment shall be of two coats of synthetic enamel paint of approved color & shade.
Degreasing : Concentration of chemical :5%-7% &
40 deg C De rusting : Concentration of chemical : 25%
Phosphatising : Concentration of chemical : 3.5% & 40-50 deg C
Passivation : Concentration of chemical :0.05%-0/1% &
60-70 deg C

Two coats of zinc chromate primer should be applied after the above processing before baking in oven.
Wherever necessary filler putty is applied to make the surface smooth. Properly rubbed surface is to be given a coat of surface and baked in oven.

Testing

Motor control centre shall be tested at manufacturer's works. The test certificates shall be got approved before dispatch of MCC to site.

Instrument Compartment

All instrument shall be flush mounted 144 mm square & suitably scaled. Instrument chamber should have sufficient space. Indicating lamps should have minimum 50 mm space between them. They shall be accessible for testing and maintenance without any danger of accident and contact with live parts of circuits breaker and bus bar.

Control Cables and Terminals

All control wiring shall be with minimum area of 1.5 Sq mm copper conductor. These shall be ferruled coded and identified at both ends as per IS specifications. A horizontal wire way shall be provided along the length of panel for taking the control wiring from one section to another control wiring when terminated, shall be terminated on the terminal block and identified for the duties to be performed. Each terminal shall be separately identified. Minimum 10% spare terminals shall be provided on every terminal block.

Other Components

Moulded Case Circuit Breaker (MCCB)
The MCCB (moulded case circuit breaker) shall conform to the latest IEC 947-2 & IEC 947-3–1989. The Service Short Circuit Breaking Capacity (Ics at 415VAC) should be as specified at the required level. The MCCB shall be Current Limiting type and comprise of Quick Make – Break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the Tripping unit, contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCBs shall

be capable of defined Variable overload adjustment. All MCCBs rated 200Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall over ride all other commands. The MCCB shall employ maintenance free double break contact system to minimize the let thru energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let thru energy curves. The MCCB shall not be restricted to Line/ Load connections. The handle position shall give positive indication of ON', OFF'' or Tripped' thus qualifying to Disconnection as per the IEC947-3 indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

Miniature Circuit Breaker (MCB)

Miniature Circuit Breaker shall comply with IEC898 – 1996. The Miniature circuit breakers (MCB) shall be quick make and break type for 230 / 415 VAC 50 Hz application with thermal magnetic releases for over current and short circuit protection. The Breaking capacity shall not be less than 10 KA at 415VAC. MCBs shall be DIN mounted. TheMCB shall be Current Limiting type (Energy Class–3). MCBs shall be classified (B,C,Das per the IEC 898 standards) as per their Tripping characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

Switch Fuse Units

a. High rupturing capacity fuse (HRC Fuse) shall carry ISI mark on it and shall be rated for duty as indicated on the drawing/schedule of Quantities. The rating of HRC fuse shall be as per the rating of motor/equipment. The rating of fuse shall be selected so as to provide discrimination.
b. The switch fuse units shall be three poledouble break action with switched neutral. All switch fuse units shall be provided with the hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is ON' position and also to prevent energizing the switch when the door is not properly secured. All contacts shall be silver plated and alive parts shall be shrouded. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall have rupturing capacity of not less than 31 MVA at 415 volts. All switch fuse units shall be provided with visible indicators to show that they are in ON or OFF' position. All switch units shall be of AC-23 category.

Motor Starter

The Motor Starter shall be a combination starter consisting of motor protection circuit breaker and suitable contactor for remote starting.

Earth Leakage CB / Residual Current CB

The ELCB/RCCB shall comply with IEC 1008. The ELCB/RCCB shall current operated independent of the line voltage. ELCB/ RCCB shall work on the principle of core balance transformer. The ELCB / RCCB shall be rated for current sensitivity of a Min of 30m A and a Max of 300m A at 240 / 415VAC.The terminals shall be protected against finger contact to IP20 degree of protection. The ELCB / RCCB shall have a minimum of 20,000 electrical operations.

Testing Provision for the Earth Leakage Circuit Breaker

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB and the operating handle shall move to the "OFF" position.

AIR CIRCUIT BREAKER (ACB):

The ACB shall conform to IEC 947-2-1989 & IS 13947 (Part –2). The Service Short Circuit Breaking Capacity shall be as specified and equal to the Short circuit Withstand Values. The ACB shall be provided for controlling the incoming supply feeder or as required and specified in schedule. Shall be available in 3 or 4 pole with modular construction, fixed or draw out, manually or electrically operated versions as specified. ACB shall be capable of providing short circuit, overload and earth fault protection (in absolute values) if required, through micro processor based control unit sensing the true RMS values to ensure accurate measurement meeting the EMI/ EMC requirement as per the standard.

The breaker should have 3 distinct positions – SERVICE / TEST/ ISOLATED within the cubicle. It should be possible to withdraw the breaker for testing with the door closed. Safety interlock must be provided to prevent the ACB from falling out in a fully withdrawn position. The ACB shall be provided with a door inter lock. The contacts should be copper and silver plated only with a feature of contact wear inspection indicating the life of the contacts. The ACB shall have double insulation with moving and fixed contacts totally enclosed for enhanced safety and inaccessibility to live parts.

All electrical closing of breaker should be with Electrical motor wound stored energy spring closing mechanism with Mechanical indicator to provide. ON/OFF status of ACB.

For all ACBs the Operating handle should be provided for charging the spring in continuous action. The spring shall be released with ON / OFF push button command in one operation at the correct speed independent of operator speed. A direct mechanical coupling should indicate the ACB in ON or OFF position thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. One set of NO / NC potential free contacts to be provided for operation on Building Management System. All accessories like shunt, under voltage motorized mechanism etc shall be front mounted, requiring no adjustments and can be fitted at site.

The manufacturer shall provide details of opening time and deration with temperature to ensure dis crimination and proper selection for feeders protection.All ACBs of 4000 A and above shall be a single ACB and Tandom operated will not be acceptable.

Safety Features

1. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
2. It should not be possible to interchange two circuit breakers of two different thermal ratings.
3. There should be a provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism.
4. Earthing bolts must be provided on the cradle or body of fixed ACB. Arc Chute covers should be provided wherever necessary.
5. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, voltmeter and ammeter of size not less than 96mm x 96mm, selector switches, fuses for potential circuit and current transformers.
6. It should be possible to bolt the draw out frame not onlyin connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.

Protections

1. The Electromagnetic and thermal release or Microprocessor based unit should be provided on circuit breaker for short circuit, over current and earth fault protection with adjustable settings.
2. Specific LED indications should be provided for over current and earth fault operation.
3. Relays should be CT operated through shunt trip for short circuit and earth fault protection.
4. Under voltage relays should be provided.
5. Minimum 6 NO and 6 NC auxiliary contacts shall be provided on each breaker. The contacts shall be rated 5 Amps.
6. Rate D insulation voltage is1000 volts AC.

Push Button Stations

Push button stations shall be provided for manual Start & Stop of equipment. Push button shall have ON & OFF indicating lamp in red and green colour. Push button shall be fabricated in 16 gauge sheet steel.

These station shall be factory fabricated. ON & OFF operations shall be carried out from front without opening the door. One set of NO & NC contact shall be provided in push button station as spare.

Toggle Switch

The toggle switch shall be of minimum 5 Amps rating.

Thermal Overload

The relay shall be factory calibrated, sealed and suitable for an ambient temperature at site or 50 deg C whichever is higher.
It should provide reliable and accurate protection against overload, single phasing and locked rotor conditions. Relays are to be provided with:

(a) Tripal arm contact

(b) Tripleverfortesting
(c) Auto reset facility

Rated insulation voltage shall be6 60 volts AC.

INSTRUMENTS

a. General:

The specifications here in after laid down shall cover all the meters and instruments.

b. Instrument Transformers

(i). CurrentTransformers

Current transformers shall be in conformity with IS : 2705 (Part I,II,III & IV) in all respects. All current transformers used for medium voltage applications shall be rated for1 KV. However, the rated secondary current shall be 5 A unless otherwise specified. The acceptable minimum class of various applications shall be as given below:

Measuring: Class0.5to1
Protection : Class 10 p

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identifications of poles. Current transformers shall be provided with earthing terminals, for earthing chassis frame work and fixed part of the metal casing (If any). Each CT shall be provided with rating plate indicating the following:

i. Name and make
ii. Serial Number
iii. Transformation Ratio
iv. Rated Burden
v. Rated Voltage
vi. Accuracy Class

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CT"s shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat & clean manner.

c. Potential Transformers

Potential transformers shall be provided if specifically called for potential transformers shall comply with the requirements of IS : (Part I,II,III) in all respects.

d. Measuring Instruments

i. General

Directreading electrical instruments shall be in conformity with IEC-51,BS:89 or IS :1248. The accuracy of direct reading shall be 1.0 for voltmeters and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The meters shall be suitable for continuous operation between -10 deg C and +50 deg C. All meters shall be of flush mounting type with square pattern. The meter shall be enclosed in a dust tight housing. The meters shall be provided with white dials and black scale markings. The

pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside.

ii. Ammeters

Ammeters shall be of moving-iron type. The moving part assembly shall be with jewel bearings. The jewel bearing shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks. The ammeters shall be manufactured and calibrated as per the latest edition of IS: 1248 or BS:89. Ammeters shall be instrument transformer operated, and shall be suitable for 5 A secondary. Upto 30 Amps the ammeter shall be direct operated without current transformer on one phase only. Beyond 30 Amps the ammeter shall be CT operated with selector switch.

iii.Volt meters

Volt meters shall be of moving-iron type. The range for 400volts, 3 phase volt meters shall be 0 to 500 volts. The volt meter shall be provided with protection fuse of suitable capacity

Earthing

a. General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS- 3043. All metal conduits, trunking, cable sheathes, switchgear, distribution boards and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to control panel. Earthing shall meet the requirements of IER 1956.

b. Earthing Conductor

All earthing conductors shall be of high conductivity copper as specified and shall be protected against mechanical damage and corrosion. The size of the earth conductor shall not be less than half of the largest size of the current carrying conductor. The connection of the earth continuity conductor of earth and earth electrodes shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cablet rays or conduit sand cables by using suitable clamps made of nonferrous metals. Incoming power supply along with earthing upto MCC/AHU control panel shall be provided by other agency. The panel shall be earthed to building main earthing. The motor shall be double earthed to the panel.

The earthing shall be done with wires/flat as under:

Sl. No.	Equipment	SizeofEarth Wire/Strip	
		GI	Copper
1.	Motors Upto 5 HP	2 Nos 8 SWG	2 Nos. 14 SWG
2.	Motors Upto 15 Hp	2 Nos 8 SWG	2 Nos 12 SWG
3.	Motors Upto 30 HP	2 Nos 4 SWG	2 Nos. 8 SWG
4.	Motors Upto 50 HP	2 Nos 25x6 mm Flat	2 Nos. 4 SWG
5.	Motorsabove50 HP	2 Nos 32x6 mm Flat	2 Nos. 5x3 mm Flat.

AHU electrical panel shall generally be wall mounted type. Above stated specifications shall also stand good where applicable. The AHU motor shall be double earthed with two independent earth conductors as per the Indian Electricity Rules & Regulations-1956.

Medium Voltage Cable

a. Type

Medium voltage cables shall be aluminium /copper conductor, PVC insulated, PVC sheathed and steel wire armored or steel tape armored construction.

b. Rating

The cable shall be rated a voltage of 660/1100 volts.

c. Construction

The conductors shall be made of electrical purity aluminium 3/4 or H temper/copper. The conductor shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of un vulcanized compound.

Armouring shall be applied over the inner sheath of bedding. Over the armouring a tough outer sheath of PVC sheathing shall be extruded. The armouring shall be of single layer, galvanised steel round wire or flat strip. Wire armour should be used for cable dia over inner sheath upto 13mm and strip armour to be used for higher dia. The outer sheath shall bear the manufacturer's name and trade mark at every meter length.

d. Core Identification

Cores shall be provided with the following colour scheme of PVC insulation:
Core 1 :Red/Black/Yellow/Blue
Core 2 :Red &Black
Core 3: Red,Yellow & Blue
Core 4: Red,Yellow,Blue & Black

e. Current Rating

The current ratings shall be based on the following conditions:

i. Maximum conductor temperature: 70 deg C
ii. Ambient Air temperature : 43 deg C
iii. Ground temperature : 30 deg C
iv. Depth of laying : 75 CM

f. Short Circuit Rating

Short circuit ratings for the cables shall be as specified in IS:1554-Part I.

g. Selection of Cables

The cables shall be suitable for effectively earthed A/C system 415volts, 3Phase50 Hz.

Cables have been selected considering the conditions of the maximum connected load, switch rating ambient temperature, grouping of cables and the allowable voltage drop. However, the contactor shall recheck the sizes before the cables are ordered and brought to site. Discrepancy if any, shall be brought to the notice of Consultant.

h. Laying of Cables

For laying of cables along building steel structure and technological structures the cables shall be taken by clamping with MS saddles screwed to the MS flat welded to the structure. MS saddles and flats are to be galvanized after fabrication so that there is no rusting during maintenance period.

For laying cables along concrete walls, ceiling etc. The cables shall be taken by clamping with MS saddles screws to the MS flat welded on to the inserts. Where inserts are not available the saddles shall be directly fixed in the wall using rowl steel plugs of sufficient capacity and MS flat spacers of minimum 2mm thick.

The MS saddles shall be spaced at an interval, not more than 500mm both for horizontal and vertical runs. However, at the bends, it shall be spaced within 300 mm and where terminating to the equipment/junction box the cable shall be clamped immediately before such terminations. In the area prevailing with corrosive atmosphere, PVC saddles instead of MS saddles shall be provided.

Underground cables shall be laid not less than 750 mm below ground. The width of the trench shall be 300 mm minimum for single cable. For additional cables additional widthof 150mm for each cable is to be added. The sand should be spread in trench as under.

The cushion of sand to be provided below and above the cable joint boxes etc must not be less than 80mm i.e, total depth of sand shall be 160mm minimum. The sand should be spread in trench as under.

1. After laying the cable in trench 80mm of sand should be put over the cable. The cable should then be lifted and placed over the sand bed and the balance 80mm of sand put over it.
2. Where cable is laid in rocky situation extra thick cushioning of sand as may be decided by site in charges shall have to be done without any extra cost.

Filling of trenches shall be done after the sand cushioning and laying of tiles/bricks are carried out to the satisfaction of the engineer.

Cable Trays

1. Trays shall have suitable strength and rigidity to provide adequate support for all cables.
2. Shall no thave sharp edges, burrs or projections injurious to cable insulation.
3. Shall be adequately protected against corrosion.
4. Shall include fittings factory fabricated or other suitable means for change of direction and elevation in run.

Installation of Trays

Trays shall be installed as complete system supported properly and rigidly from the building structure.

Each run of cable tray shall be completed before the installation of cables. Cable trays shall be accessible.

Noncombustible solid barriers shall be used for segregating the cables of different systems on the same cable tray. Cable trays shall be grounded by2 Nose arthstrips. Trays shall not be used as equipment grounding conductor.

Testing

a. Cables shall be tested as per the requirements of IS 1554. The tests shall be incorporate routine test and acceptance tests. Type test certificate shall be furnished whenever demanded.
b. Tests shall be carried out atsite and submitted to project authorities.

Cable Identification Tag

Suitable cable identification tag shall be placed along the route of cable at every10 meters and bends. The tags shall be of size 150 mm x 100 mm x2 mm aluminium sheet. It shall be punched with similar details as given below.

Cable from	MCC or AHP-1
Cable to	CDWP-1 or CT-1
Size of cable	2 Nos 3Cx 6 Sqmm.

Drawings

Shop drawing for MCC/control panels and wiring of equipment showing the route of cables shall be got approved by the Consultants before starting the fabrication no f panel and starting the work.

List of equipment & accessories which contractor has to bring and maintain at his own cost at the site during the currency of the contract in good condition.

PLANT / EQUIPMENT	**NUMBER**
01. Floor mounted drill machine	1
02. Hand drill machine with drill bits	2
03. Hammer Drill machine with drill bits	2
04. Lock forming machine for duct fabrication	1
05. Handheld lock closing machine	1
06. Electric Pitts burg Seamer for closing pitts burg joints	1
07. Electric Slitting shear for making cut outs	1
08. Handheld Collar cutting machine	1
09. Mechanized saw for cutting angles & channels	1
10. Duct smoke test kit	1
11. For application of closed cell elastomeric insulation	
i. 1200 long steel scale	1
ii. 1200x900size40 mm thick commercial plyboard	1
iii. Sharp knives of different sizes	12

12. Tripod switch chain pulley blocks 4

and any other equipment required for efficient execution of work within the stipulated period.

HVAC SERVICES SCHEDULE OF QUANTITIES

1. All equipment described hereafter shall be in accordance with the specifications.
2. All equipment shall be selected and installed for the lowest operating noise level.
3. Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Consulting Engineer/Project Managers, procurement of equipment, transportation, shipping, payment of all taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components and warranty obligations for the individual equipment.
4. Installation of various equipment shall include all material and labour associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting & anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.
5. Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and sound power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.
6. Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.
7. Testing and commissioning shall include furnishing all labour, materials, equipment, instruments and incidentals necessary for complete testing of each component as per the specifications & manufacturer's recommendations, submission of test results to the Consulting Engineer/Project Managers, obtaining their approval and submission of necessary completion documents & drawings.
8. All ducts shall be fabricated and installed conforming to the relevant Indian Standards, approved shop drawings and the specifications.
9. Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, distribution grids within the ducts in position extruded aluminium hardware fittings such as handles, thunder bolts,

hinges, factory fabricated access door and providing, installing, MS hangers with dash fasteners, foam rubber insertions, nuts, bolts and screws as required. Making all joints air tight using rubber insertions. Multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flow. All primer coated MS hangers, dampers, base frames etc. shall be painted with black enamel paint.

10. All registers and diffusers shall be provided with a soft continuous srubber gaskets between their periphery and the surface on which these have to be mounted.

11. MS registers and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved colour. Aluminium grilles and diffusers shall be fabricated out of extruded aluminium sections.

12. After completion of the installation, the entire air distribution system shall be tested for leaks and balanced in accordance with the specifications.

Mode of Measurement

The mode of measurement for the various items, unless otherwise specified, shall be as follows:

Ducting

Payment for ducting shall be made on the basis of the external surface area of the ducting including all material and labour for installed duct.

The rates per Sq M/S ft of the external surface shall include MS angle iron/ GSS flanges, gaskets for joints, nuts & bolts, duct supports & hangers, vibration isolation pads or suspenders, dash fastners, inspection doors, dampers, turning vanes, major hardwares such as thunder bolts, hinges, handles in extruded aluminium construction and any other item which will be required to complete the duct installation except external insulation and acoustic lining.

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

In case of taper pieces average width and depth will be worked out as follows:
W1 = width of small cross section
W2 = width of large cross section D1 = depth of small cross section D2 = depth of large cross section Average width = $\frac{W1 + W2}{2}$

Average depth = $\frac{D1+D2}{2}$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections fitted with angle iron flanges, otherwise at the bottom of the flange where flanges are of duct sheet. For the circular pieces the diameter of the

section mid-way between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface at the taper piece. For the face length of taper piece shall be the mean of the lengths measured face to face from the centre of the width and depth of flanges. Duct measurements for calculation of area shall be taken before application of insulation. For the special pieces like bends, branches, and tees etc. same principle of area measurement as for linear lengths shall be adopted except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature or angle of the piece.

Duct Insulation

This item is provided separately for various thickness and shall be paid for on area basis of uninsulated duct. The area of the duct to be insulated shall be measured before application of insulation.

Grilles & Diffusers

All extruded aluminium grilles and diffusers shall be paid on the basis of actual measurement at site. Area of extruded aluminium diffusers shall be derived from neck size i.e. 225x225,300x300,375x375 & 450x450. However, payment of 600x600 diffusers shall be paid based on the actual diffuser size excluding flanges and not the neck size.

Refrigerant Piping

Refrigerant piping shall be measured on linear length basis including bends and fittings.All quantities indicated in this schedule are for Contractor's guidance only.
Appropriate troughs in the suspended ceiling be provided for terminating duct collars for diffusers & grilles by other agencies to achieve desired interior finishes.

TECHNICAL PARTICULARS

Air cooled Variable Refrigerant Flow System

Outdoor units (Cooling only type)

Make and model

a. HP of Outdoor Unit
b. Capacity in TR(Nominal)
c. Quantity
d. Type
e. Permissible length of refrigerant piping from ODU to farthest IDU.
f. Type of compressor
g. No of compressors (Each Outdoor unit)
h. No of inverter driven compressors (Each Outdoor unit)
i. Air entering temp. condensing deg C
j. Dimension of ODU in mm (HxWxD)
k. Are bigger ODUs, above16HP,

provided with 2 separate inverter compressors for proper duty cycling and higher reliability as specified.

l. Confirm whether dedicated Intelligent touch controller with colored graphic LED display provided to act as BAS for VRF system.

External static pressure available in ODU. Type of anticorrosion treatment on fins of ODU.

Type of Heat exchanger in ODU

Setup availability for Night timed brelaxation

Confirm availability of features for reduction in fan noise and pressure loss on ODU

Is it possible to incorporate automatic address setting of each IDU & ODU ? Otherwise specify alternate function available.

Indoor Units - Ductable

a. Manufacturer
b. Type
c. Capacity (TR)
d. Airflow Min/Max. (Cfm)
e. Sound level (Hi/Lo)
f. Overall Dimensions (LxWxH)
g. Unit weight (Kg)
h. Is remote controller (corded) provided for each indoor unit (Yes/No)

Centralized Controller– Touch Screen Type

(2 Nos. For complete VRV/ VRF System)

Detail of operation

Local Remote Controller
Detail of operation

Inline Fans
a. Manufacturer
b. Motor Characteristics
c. Whether speed regulate or provided for single phase fans

Propeller Fans

a. Manufacturer
b. Motor Characteristics
c. Capacitors Provided
d. Speed Regulator
e. Gravity Louvers
f. Single Phase Preventor g Back Draft Damper
h. Bird Screen
i. Wireguard.

GID rain Piping

a. Make
b. Materialfor pipes.

Ducting - Manufacturer

Type of Material

Class of GSS

a. "K" value at 10 degree C mean temp.
b. Thickness

Grilles, Diffusers and Dampers

Make, Material and Gauge of following items:
a. Fire Dampers
b. Grilles: i. Extruded aluminium
ii. Mild Steel
c. Diffusers: i.Extruded aluminium
ii. Mild Steel
d. Duct Dampers

e. Grille Dampers Insulation

A. Duct Acoustic Lining

a. Material
b. Manufacturer
c. Density
d. Thermal Conductivity
e Thickness

B. Thermal Insulation of Ducts

a. Material
b. Manufacturer
c. Density
d. Thermal Conductivity
e. Thickness

C. Exposed Duct Thermal Insulation

a. Material
b. Manufacturer
c. Density
d. Thermal Conductivity
e Thickness

D. Drain Pipe Insulation

a. Material
b. Manufacturer
c. Density
d. Thermal Conductivity
e Thickness

Electrical Accessories

Make of the following:

a. Motor control centre
b. MCCBs
c. Change Over Switch
d. Star Delta Starter
e. Direct On Line Starter
f. Contactors/Over|LoadRelays
g. Current Transformers
h. Single Phase Preventors

i. Push Buttons
j. AmmeterAndVoltmeter
k.Indication Lamps
l.Power Cables
m.Control Cable

LIST OF APRPOVED MAKES FOR ELECTRICAL WORKS

APPROVED MAKES OF EQUIPMENT & MATERIALS

Sl. No:	EQUIPMENT	MAKE
1	POWER / CONTROL CABLING	POLYCAB /HEVELLS/KEI/RR CABEL
2	SIGNAL CABLES - FRLS	POLYCAB /HEVELLS/KEI/RR CABEL
3	COMMUNICATION CABLES - FRLS	POLYCAB /HEVELLS/KEI/RR CABEL
4	PVC CONDUITS - FRLS - ISI MARKED	BEC /D PLAST / PRECISION/ VIP/POLYCAB/KOHINOOR
5	MS & GI CONDUITS	BEC / BHARAT / JPC
6	CABLE TRAY	PROFAB / INNOSPACER / UNIVERSAL/GREENT
7	PUSH BUTTON STATION	SIEMENS / TECHNIK
8	RELAY & CONTROL PANELS	POWER CONTROL EQUIPMENT / PRAGATHI / BLUEVOLT/AIR MASTER/RAYOTECH
9	LV BOARDS, MCCs	POWER CONTROL EQUIPMENT / PRAGATHI / BLUEVOLT/AIR MASTER/RAYOTECH
10	CAPACITORS	UNIVERSAL/ ASIAN / MEHER
11	CONTACTORS & STARTERS	TELEMECHANIQUE / ABB / SEIMENS/POWER CONTROLEQUIPMENTS/BLUEVOLT/AIR MASTER/RAYOTECH
12	FUSES & FUSE BASES	HAVELLS / STANDARD / GE
13	SWITCH FUSE & FUSE SWITCH UNITS	HAVELLS / STANDARD / GE
14	SELECTOR SWITCHES & ROTARY SWITCHES	EE / KAYCEE / SALZER
15	AIR CIRCUIT BREAKERS	SCHNEIDER / ABB / LEGRAND
16	MOULDED CASE CIRCUIT BREAKERS	SCHNEIDER / ABB / LEGRAND
17	MINIATURE CIRCUIT BREAKERS	HAGER / SCNEIDER / LEGRAND
18	RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB)	HAGER / SCNEIDER / LEGRAND
19	RELAYS	BCH / L&T / TELEMECHANIQUE
20	TIMERS	MDS LEGRAND / TELEMECHANIQUE
21	INDICATING LAMPS (LED)	VAISHNAV / C & S / L&T
22	MCB DISTRIBUTION BOARDS	HAGER / SCNEIDER / LEGRAND
23	DIGITAL INDICATING METERS	L & T / TRINITY / SCHNEIDER
24	HT & LT CABLES (POWER & CONTROL)	POLYCAB / HAVELLS / KEI
25	PVC INSULATED COPPER WIRES (FRLS)	FINOLEX / LAPP / RAJANIGANDHA/ POLYCAB /HEVELLS/KEI/RR CABEL
26	PVC INSULATED TELEPHONE & CO-AXIAL WIRES & CABLES	FINOLEX / LAPP / RAJANIGANDHA/ POLYCAB /HEVELLS/KEI/RR CABEL
27	TERMINALS	ELMEX / WAGO
28	VRV/VRF – HVAC SYSTEM	MITSUBISHI / TOSHIBA / DAIKIN /CARRIER (will be removed)

29	VIBRATIONAL ISOLATION MOUNTS	GETZNER
30	COPPER PIPE	MANDEV / RAJCO /TOTALLINE/PARASAMANI/MEXFLOW
31	DRAIN PUMP	ASPEN / SICCOM
32	CPVC PIPE	SUPREME / PRINCE / ASTRAL/TATA/Ashirvad
33	NON PENEREATIVE SUPPORT SYSTEM	BIG FOOT / PHP / MIRO INDUSTRIES
34	STRUTS, FASTENERS & OTHER SUPPORTS	HITECH / HILTI / FISCHER
35	GI SHEET	TATA / JINDAL
36	DUCT FABRICATION	ZECO / ROLOSTAR / CAM DUCT / DEV DUCT/SREE FABRICATORS
37	DOUBLE SKIN PLENUM	CARRYAIRE / VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA/VTS/DEV DUCT/SREEFABRICATORS
38	VOLUME CONTROL DAMPER	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
39	BUTTERFLY DAMPER	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
40	FLEXIBLE DUCTS	ATCO / UP TWIGA / SEVEN STAR / SUPAFLEX
41	COLLAR DAMPER	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
42	SPILL AIR BOX	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
43	ALUMINIUM GRILLES, DIFFUSERS, JET NOZZLES, LOUVERS ETC	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
44	FIRE DAMPER-UL 555 CERTIFIED	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
45	BACK DRAFT DAMPER	CARRYAIRE / MNKOOLAIR /SURYAAIRSYSTEM /VYHAN/VTS/AIRMASTER/SYSTEMAIR/AJANTHA
46	NITRILE RUBBER / XLPE INSULATION	ARMA FLEX / THERMOBREAK / K FLEX / AERO FLEX/SUPREM /AEROLAM/AEROCELL
47	ACTUATOR	BELIMO / SEIMENS / JCI
48	STARTER PANEL	RAYOTEC / BLUEVOLT / SK ELECTRICALS / c & s ELECTRIC TARUN POWER SYSTEMS

NOTE :-In Case of non-availability of material in the preferred make list, Prior approval of the Engineer-in-Charge shall be taken for material of other make.

13. HVAC CAMC for 2 Years

1) The scope of work as mentioned below are the minimum expected from the vendor apart from break down maintenance and any other work required for maintenance in proper way as per the operation& maintenance manuals of respective equipment and as per good engineering practices will be required to be done under this scope of work. The successful bidder will make Proforma for recording the minimum work schedule/parameters and show to the employer to ensure proper accomplishment of these tasks.

2) A technically competent staff shall be deputed by the vendor on all the working days for regular monitoring and maintenance.

3) All the equipment's /installations shall always be kept in good and trouble-free operating conditions.

4) All the required record for breakdowns /repairs and maintenance etc. shall be maintained in the form of history books, logbooks etc. as per directions.

5) All the maintenance works shall be carried out in accordance with the manufacturer's specifications and instructions of the CCMD.

6) If for any reason any equipment is required to be repaired from any outside agency or in any workshop, the same shall be arranged by the agency at his own cost within the quoted prices.

7) Watch and Ward of their material, machineries, and system etc. till end of the contract shall be the sole responsibility of the contractor and pilferage etc. shall be entirely to his account.

8) In case of any damage caused to the installation due to negligence, carelessness, or inefficiency of staff of the firm the contractor shall be responsible to make good the loss. The decision of the CCMD shall be final & binding on the vendor.

9) Attending complaints of routine as well as breakdown maintenance of all the system to be done.

10) All tools & tackles, manpower, transportation, and other resources required for executing the job shall be in the scope of the contractor. No extra charges will be paid by the authority regarding tools & tackles, manpower, transportation etc.

11) The vendor must maintain a maintenance register during each visit mentioning what kind of job has been done during that visit. The vendor should also provide maintenance report.

12) The vendor shall depute a single person who will control this Annual maintenance work, so that authority can contact him for any kinds of problem of all system.

13) The unit rates quoted should be kept firm and valid during the entire period of contract and no escalation shall be permissible for any reason whatsoever after award of contract.

14) The rates quoted by vendor shall include all liabilities such as supervision, wages, overtime, leave, bonus, increment, retrenchment compensation, insurance and all other statutory payments, including providing of tools and tackles under contractor's scope of supply, overheads, profits etc. for which no extra payment will be made.

15) All the general & special tools, tackles required for proper maintenance and repairs/break down etc. shall be arranged by the vendor at his own cost.

16) **Operation of the HVAC system:** The vendor shall provide 3 skilled operator (ITI Qualified)in general shift per day (From 9 AM to 6 PM). Totally 3 operators shall be provided by the vendor. The operators shall keep the system in operating condition and ensure proper operation of the system. They should maintain the record of the parameters of the HVAC system.

17) CONSUMABLES**:**

a) The rates shall be all inclusive of establishment as well as spares and consumables as per schedule of work. The vendor is required to assess the probable quantity of all types of spares and consumables likely to be required for replacement for keeping all the installations in good working conditions and include the lump sum cost of these spares & consumables. Nothing extra on any account shall be payable .
b) The consumables and spares shall be of best standard quality purchased from the original manufactures or authorized dealers only and shall be approved by the CCMD before use.
c) All spares and consumables shall be arranged by the vendor for which nothing extra shall be payable.
d) A list shall be prepared by the Vendor for major& minor spares consumables and the decision of CCMD regarding the major/minor consumables shall be final.
e) Replaced parts/ spares, used brunt oil etc. will be property of the vendor. It is his responsibility to disposed of immediately.

18) **PENALTY CLAUSE:**

a) If the fault is of the minor nature and not attended within 12 hours, then a penalty @ rate of Rs.500 per day shall be imposed on vendor for each location separately and will be deducted from the AMC amount due to the vendor and if unsatisfactory performance is continued for more than two days as felt by the CCMD and the AMC is liable to be terminated and final decision for this shall rest with the CCMD.
b) If the vendor is NOT able to locate and rectify the fault and the reasons attributable to non-performance of vendor as assessed, the penalty clause is applicable as system remained non- functional for 2 hours or more. The penalty will be Rs.1000 per day.
c) If vendor is not able to rectify the fault, then the same may be got done through some other agency at the risk and cost of vendor failing which the same amount will be deducted from AMC bill in addition to the penalty as stipulated above will also be imposed. However, the decision of the CCMD in this regard shall be final and binding.

19) **Other conditions:**

a) The vendor shall be responsible for the safety of their manpower, all the items of furniture, plants, office equipment and other fittings provided in the premises and shall be liable to make good any loss to the same if damaged during the execution of their duties which shall be recoverable from their bill or other dues payable to the vendors by the company.
b) The monthly bills for the service shall be submitted by the vendors at the end of every month and the same will be settled after due scrutiny only.
c) The vendor should deploy the personnel after screening/approval from the CCMD.

d) The vendor shall be responsible for the good conduct and behaviour of their employees. If any employee of the vendor is found misbehaving with the supervisory staff or any other staff member, the vendor shall terminate the services of such employees at their own risk. The vendor shall issue necessary instruction to their employees to act upon the instructions given by the supervisory staff of office building.
e) Any material required for making good the damages will be brought by the vendor at his own cost and risk, and such material should be of proper brand and of good quality.
f) The firm will be responsible for the security/insurance of their staff working at site and the Institute will not be responsible in any manner in case of any accident / miss happenings.
g) Technical evaluation committee during technical evaluation will also review the past performance of the vendor before making them technically qualified etc.
h) The vendor should visit the site and acquaint themselves of the conditions existing, restrictions in movements / working hour's security aspects, Condition of the plant equipment to be maintained / operated, before quoting for the job. No complaint of loss of labour, items of work not included in the scope of work variation etc. will be entertained in handling similar works and should attach copies of cases handled by them along with performance certificate.
i) They shall be responsible for any periodic statutory inspection to be carried out on the equipment necessary test report and certificate rectification of defects, pointed during such inspection etc.
j) Vendor should follow all safety norms and provide necessary safety equipment at their own cost. In case of any accident during the maintenance of the equipment leading to injuries / damages to human beings and equipment and / or loss of life, the vendor shall be fully responsible for setting all claims and indemnify the Centre against any claims arising out of such accidents. Consequent damages to other systems will however be recoverable from the vendor.
k) This contract can be terminated by the IISc without assigning any reasons by giving a notice period of 30 days at any time during the period of contract. No claim for any compensation will however be entertained due to such termination prior to the expiry of stipulated period of contract.
l) All the equipments/installations shall always be kept in good and trouble-free operating conditions. All the required record for break-down repairs and maintenance etc. shall be maintained in the form of history books and logbooks etc. as per directions.
m) All the maintenance works shall be carried out in accordance with the manufacturer's specifications and instructions of the CCMD Engineers.
n) At the end of the CAMC vendor should replace all the filters and other consumables with the new before handing over the CAMC to other vendor/Institute.

20) **PAYMENTS:**

a) **PAYMENT TERMS:** Payment shall be made on <u>monthly basis</u> after submission of bills in the succeeding months after due scrutiny and examination.
b) If performance is not found satisfactory, payment for that month will be forfeited and if un-satisfactory performance is continued then the contract is liable to be terminated. The bill should be presented at the end of every month inclusive of all taxes.
c) The vendor shall submit the satisfactory performance certificate from the building in- charge in support of the monthly claim.

21) **PERIOD OF CONTRACT**:

The contract shall be in force for an initial period of **one year**. The contract can be terminated by either party by issuing one-month advance notice in writing.

Monthly Maintenance:-

a) Maintenance of all filters, strainers, diffusers, cooling coils, drain lines, Vents, Refrigerant Gas make up etc.
b) Tightening of belts, foundation bolts of equipment, alignment of belt pulleys and couplings.
c) Examining dampers & operating linkage for smoothness.
d) To check the gland/seal, coupling of pumps.
e) To check the valve, safety controls mechanical, Electrical/ Electronics and inter-locking of the various equipment's.
f) To check all ducts/ insulation/ proper positioning/ damage and rectifying the same wherever required.
g) Inspect/check entire line for leakage and rectification of leakage,if any.
h) To check and lubricant (if required) the bearing of the pumps/motors/fans and keep the proper record.
i) To check the foundation bolts of the pumps / motors and to take the necessary action if required.
j) Check the quantity of Airflow from various outlets in each room/Area as per drawings and do adjustment of dampers etc. as and when required.
k) Operating Temperature of each lab shall be noted in log book and submit the details along with monthly report.
l) Check the performance of each equipment of HVAC plant for proper functioning.
m) Any other job required to be attended during course of Checking and to keep the plant in perfectly working conditions.
n) Cleaning of the indoor filters and outdoor condenser etc.
o) Check and clean the drain line and filter.

Quarterly Maintenance:

a) Checking/setting/rectification of all safety and automatic controls.
b) Cleaning of strainers, drain lines.
c) Maintenance of Air Blowers, Fresh Air & Exhaust Air Fans and their Balancing, if required. Observe the operation of all the dampers and make necessary adjustment in linkage and blade orientation for proper operation.
d) Functional checks & calibration of all gauges, switches, thermostats, humidist at and other instruments rectification of the same if required.
e) Any other job required to be attended during course of checking / as per OEM and to keep the plant in perfectly working conditions.
f) Maintenance of all Electrical equipment Feeders, Panels, Bus Bars, Cubicles, Motors, Heaters, Circuit Breakers, Power Points, etc. in HVAC panel as per standard electrical maintenance practice and as directed by the Engineer In charge. The maintenance and repairing of motors, Software re installation (if required) etc. are also within the Vendor's scope of work.The gas charging in will be executed by vendor, if required

BOQ

BOQ for Dismantling old VRF units, Supply, Installation, Testing and Commissioning of new VRV/VRF Systems inclusive of 02 Years Comprehensive AMC of the Installed HVAC system at Department of Biological Sciences. Indian Institute of Science. Bangalore			
Sl.No.	**Item Description**	**Quantity**	**Units**
1.01	**Higher Side:**OUT DOOR UNIT - **Supply** of VRF Outdoor condensing unit comprising of Inverter twin rotory compressor's, Heat Exchanger, propeller / axial fans, refrigerant circuit, Safety Devices & Oil Recovery System, operating on R410a refrigerant gas. Microprocessor based control panel, able to integrate with BMS of any make seamlessly. Necessary hardware / software must be included. First charge of Refrigerant Gas and oil charge.Compressor shall be Inverter twin rotory compressor and shall be equipped with inverter controller of Insulated Gate Bipolar Transistor (IGBT) type to be efficient & quiet. Outdoor unit shall have step less capacity control with ALL INVERTER Compressors.Minimum two or more compressors per Out door module Condenser : Air-cooled condenser, shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fin coil. Aluminium fins shall be coated with anti-corrosion coating.Refrigerant Circuit shall include an accumulator, liquid and gas shut off valves and a solenoid valves. Outdoor unit shall include the following safety devices:High pressure switch, Low pressure switch, Fan motor safety thermostat, Inverter overload protector, Over Current relay, Fusible plugs, Fuses, Spring type vibration isolators etc., Outdoor unit supporting arrangement, foundation block, supporting MS platform, Painting with two coats of black paint.Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigerant piping.Unit shall be equipped with power fluctuation safety devices to address frequent power fluctuations.Complete electrical power wiring of Aluminum & control wiring of copper required from indoor and outdoor units. Earthing of the complete system with 8 G G.I wire.Electrical Panel will be complete with necessary starters, fuses, switches, timers, over-load relays, contactors, push button and indicating lamps, single phasing PREVENTOR etc.,All outdoors units shall be mounted on MS angle base frame structure duly black painted with synthetic epoxy paint.Frame structure shall be mounted on MS plate & serrated rubber pads.Complete clamping and saddling of cabling work and refrigerant piping, covered with PVC conduiting.Cooling only applicationPower wiring from nearest electrical panel (Provided by other agency) to Outdoor unit running in 32mm dia GI Conduit.Local Transportation, Insurance, Loading, Unloading, Freight charges from ICD to site, Lifting of ODU to Terrace level and Indoor unit to respective floors, Levelling charges, etc.,Port Clearing Charges if anyInstallation, Pressure testing, Commissioning and Handing Over of total VRV system. Includes Indoor & Outdoor unit instalation, gas	1	Nos

	leak test and charging of refrigerant gas etc.,Necessary Hardware & Software required for BMS integrationREFRIGERANT GAS R410A ONLY High COP machines Outdoor unit should be able to withstand voltage fluctuation of +/-10% First charge of refrigerant gas Actual Cooling Capacity at Designed indoor & Out door conditions Ambient Condition: For Summer 96 deg F (35.6 deg C) DB 78 deg F (25.6 deg C) WB 45 % RHInside Design Condition:22 deg C ± 1 deg C & ≤ 60 % RH : **210HP**		
1.02	Supply:180HP	4	Nos
1.03	Supply:120HP	2	Nos
1.04	Supply:160HP	1	Nos
1.05	Supply:152HP	1	Nos
1.06	Supply:290HP	1	Nos
1.07	Supply:172HP	2	Nos
1.08	Supply:86HP	1	Nos
1.09	Supply:140HP	1	Nos
1.1	Supply:185HP	1	Nos
1.11	Installation : 210HP	1	Nos
1.12	Installation :180HP	4	Nos
1.13	Installation :120HP	2	Nos
1.14	Installation :160HP	1	Nos
1.15	Installation :152HP	1	Nos
1.16	Installation :290HP	1	Nos
1.17	Installation :172HP	2	Nos
1.18	Installation :86HP	1	Nos
1.19	Installation :140HP	1	Nos
1.2	Installation :185HP	1	Nos
2.01	CEILING MOUNTED HIGH STATIC DUCT TYPE - VRF:Supply of Ceiling Suspended type DUCTABLE INDOOR units with low noise, multi speed fan, multi row cooling coil, insulated extended drain pan, long life high quality filters, inbuilt drain pump, Canvas connection, corded remote control with thermostat, electronic expansion valve, fittings, supporting arrangement all complete as per Tender drawing and Specification.Units shall be suitable for input power supply of 1phase, 230volts, 50hz.Units shall be suitable for external static pressure of 200 Pascals.Noise level : < 45 dBA @ 1.0M all around the unit: **8.0 TR / 2966 CFM**	247	Nos
2.02	Supply: 4.0 TR / 1342 CFM	6	Nos
2.03	Installation :8.0 TR / 2966 CFM	247	Nos
2.04	Installation : 4.0 TR / 1342 CFM	6	Nos

3.01	REFNET JOINTS : Supply : Necessary Ref joints, valves as per the schematic drawing.	253	Nos.
3.02	Installation: Necessary Ref joints, valves as per the schematic drawing.	253	Nos.
4.01	CENTRALIZED INTELLIGENT TOUCH REMOTE CONTROLLER : Supply : A mutifunctional compact centralized controller shall be provided with the system. It shall be able to control up to 64 groups of indoor units with the following functions:- 1) Starting / Stopping of Air conditioners as a zone or group or individual unit. 2) Temperature setting for each indoor unit or zone. 3) Switching between Temperature control modes, switching of fan speed and direction of airflow, enabling/ disabling of individual remote controller operation. 4) Monitoring of operation status such as operation mode & Temperature setting of individual indoor units, maintenance information, trouble shooting information. 5) Display of air conditioner operation history. 6) Daily management automation through yearly schedule function with possibility of various schedules. Controller shall have wide screen user friendly colour LCD display and can be wired by a non-polar 2 wire transmission cable to a distance of 1 km away from indoor unit.	4	Nos.
4.02	Installation:CENTRALIZED INTELLIGENT TOUCH REMOTE CONTROLLER	4	Nos.
5.01	BMS CONNECTING KIT: Supply : Neccessary hard ware , software, integrator to integrate VRF system with BMS system of any make seamlessly.	1	Lot
5.02	Installation: BMS CONNECTING KIT	1	Lot
6.01	**Lower Side:**REFRIGERANT PIPING :Supply: Refrigerant piping liquid and suction lines between the VRF aircooled outdoor units and indoor units. Piping shall be carried out with 16 G Hard drawn copper pipes with soldered / brazed socket fittings. Both suction and liquid lines shall be insulated with closed cell nitrile rubber insulation & exposed piping shall be covered with two layers of Fibre Glass cloth and coated with two layers of shield coating. **54.1 mm with 19 mm thick tubular insulation**	600	Rmt
6.02	Supply:44.5 mm with 19 mm thick tubular insulation	400	Rmt
6.03	Supply:41.3 mm with 19 mm thick tubular insulation	500	Rmt
6.04	Supply:38.1 mm with 19 mm thick tubular insulation	200	Rmt
6.05	Supply:31.1 mm with 19 mm thick tubular insulation	600	Rmt
6.06	Supply:28.8 mm with 13 mm thick tubular insulation	600	Rmt
6.07	Supply:22.2 mm with 13 mm thick tubular insulation	600	Rmt
6.08	Supply:19.1 mm with 13 mm thick tubular insulation	450	Rmt
6.09	Supply:15.9 mm with 10 mm thick tubular insulation	500	Rmt
6.1	Supply:12.7 mm with 10 mm thick tubular insulation	600	Rmt
6.11	Supply:9.5 mm with 10 mm thick tubular insulation	600	Rmt
6.12	Installation:54.1 mm with 19 mm thick tubular insulation	600	Rmt

6.13	Installation:44.5 mm with 19 mm thick tubular insulation	400	Rmt
6.14	Installation:41.3 mm with 19 mm thick tubular insulation	500	Rmt
6.15	Installation:38.1 mm with 19 mm thick tubular insulation	200	Rmt
6.16	Installation:31.1 mm with 19 mm thick tubular insulation	600	Rmt
6.17	Installation:28.8 mm with 13 mm thick tubular insulation	600	Rmt
6.18	Installation:22.2 mm with 13 mm thick tubular insulation	600	Rmt
6.19	Installation:19.1 mm with 13 mm thick tubular insulation	450	Rmt
6.2	Installation:15.9 mm with 10 mm thick tubular insulation	500	Rmt
6.21	Installation:12.7 mm with 10 mm thick tubular insulation	600	Rmt
6.22	Installation:9.5 mm with 10 mm thick tubular insulation	600	Rmt
7.01	Supply,Installation of GI TRAY:2 mm thick perforated cable GI tray with on existing MS angle support using necessary GI bolts/nuts and washer or welding as required. 150 x 50 mm	100	Rmt
7.02	300 x 50 mm	10	Rmt
7.03	450 x 50 mm	10	Rmt
7.04	600 x 50 mm	150	Rmt
8.01	COMMUNICATION CABLE:Supply of Communication cabling of 3C x 1.5 Sqmm from Indoor to outdoor units, external wiring to be run in 1" dia GI conduit and inside wiring shall run in 1" dia PVC conduit	3000	Rmt
8.02	Installation:COMMUNICATION CABLE 3C x 1.5 Sqmm	3000	Rmt
9.01	CONTROL CABLE: Supply ,Contol wiring from all indoor units to CITRC, from out door units to CITRC, external wiring to be run in 1" dia GI conduit and inside wiring shall run in 1" dia PVC conduit	3000	Rmt
9.02	Installation :CONTROL CABLE	3000	Rmt
10.01	CORDED REMOTE CABLE: Supply of Remote cabling of 2C x 1.0Sqmm between each IDU & its wired remote to be suitably laid in 1' PVC conduit.	750	Rmt
10.02	Installation :CORDED REMOTE CABLE: 2C x 1.0Sqmm	750	Rmt
11.01	POWER CABLE: Supply of Electrical Power cable between the indoor unit and power socket with 2 Core, 2.5 sqmm / as required, unshielded copper cable, with 1 no. plug top for each IDU.	300	Rmt
11.02	Installation :POWER CABLE 2 Core, 2.5 sqmm / as required	300	Rmt
12.01	POWER CABLE:Supply of 1.1 KV grade XLPE insulated, Cu conductor armoured and PVC sheathed cables.From ODU to nearest isolator / MCCB 4 C x 25 sqmm / as required	900	Rmt
12.02	Supply: 4 C x 16 sqmm / as required	1400	Rmt
12.03	Supply: 4 C x 10 sqmm / as required	450	Rmt
12.04	Installation :4 C x 25 sqmm / as required	900	Rmt
12.05	Installation : 4 C x 16 sqmm / as required	1400	Rmt
12.06	Installation :4 C x 10 sqmm / as required	450	Rmt

13.01	EARTH WIRE :Supply and Laying of following sizs of wires for earthing and to be run with the power cables along the cable tray/wall/ceiling as necessary. 25 X 3 GI Flat for Earthing	100	Rmt
13.02	Supply : 40 X 6mm Flat for Earthing	100	Rmt
13.03	Installation :25 X 3 GI Flat for Earthing	100	Rmt
13.04	Installation :40 X 6mm Flat for Earthing	100	Rmt
14.01	Providing and fixing Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. Hot finished seamless type tubes including cost of materials, labour, usage charges of machinery complete as per specifications and as per directions of the Engineer-in-Charge	3000	kg
15.01	Supply of Condensate Drain pump kit suitable for Ductable Units. Size shall be as per OEM recommendation.	15	Nos
15.02	Installation :Condensate Drain pump kit	15	Nos
16.01	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge. Internal work - Exposed on wall 32 mm nominal dia Pipe	900	Mtr
16.02	40 mm nominal dia Pipes	200	Mtr
17.01	G.S.S DUCTING as per SMACNA Standards:Supply, fabrication and installation of GI Ducting Along with flanges, supports & all fixing materials.24G. Ducting	1811	Sqm
17.02	22G. Ducting	1200	Sqm
18.01	VOLUME CONTROL OPPOSED BLADE DAMPER :Supply of Volume control damper shall be of low leakage type with the outer shell constructed of 1.6mm thick Anodized Aluminum frame and the blade/Leaf with 1.6mm thick Anodized Aluminum. And with necessary flanges for connection etc., as per specification.	28	Sqm
18.02	Installation :VOLUME CONTROL OPPOSED BLADE DAMPER	28	Sqm
19.01	POWDER COATED GRILLES:Supply and fixing of powder coated extruded aluminium grill suitable for supply/return air including all fixing hardware etc.,. Complete. 6" extruded aluminium grill with 15 deg to 30 deg louvers	300	Mtr
20.01	COLLAR DAMPER:Supply & Installation of Collar damper constructed out of extruded aluminum alloy with multiple blade of oppose blade type. Shall be used for the Supply / Exhaust air diffuser & grilles as per the drawings & specifications	120	Nos

21.01	ACOUSTIC LINING:Supply of Accoustic lining with Physically Crosslinked open cell polyolefin foam insulation for supply and Return air duct of density 30kg/m3 with Fire Retardant grades of thickness 15 mm. NRC of material should be atleast 0.35 tested as per ISO 354-2000 and calculated in accordance with ASTM C423-90A.	900	Sqm.
22.01	Installation :ACOUSTIC LINING:	900	Sqm.
23.01	THERMAL INSULATION :Supply and installation of Thermal insulation using 13mm nitrile rubber for return air ducts.	800	Sqm
24.01	Providing & Fixing of High Acoustical False Ceiling having NRC (Noise Reduction Coefficient) 0.90 (minimum) using Integral Densified edged Eco Friendly Fully Perforated Lightweight Calcium Silicate False Ceiling Tiles with Suitable to Modular Grid Size of 600x600mm with PPGI Slimline profile Balck/White reveal T 15 Grid system for Auditoriums, Community halls, Lecture Halls, Airports, Offices, Factories and All other High Acoustics required buildings. The Fully Perforated Lightweight Calcium Silicate False Ceiling tiles shall be made from Non Cementitious Hydrated Calcium Silicate Slurry/Mixture, Reinforced recycled material with fibers and natural fillers. Free from Formaldehyde and other harmful materials. Doesn't contain any toxic ingrediants. The thickness of tiles should be 15mm at all around the edge resting portion with integral densified edge and 10mm thick at the quadrant. The tiles should have fiber glass fleece on rear side along with backing of 50mm thick rockwool slabs of density 48kg/m3 to achieve NRC 0.90 (Minimum)The tiles should have Humidity Resistance (RH) of 100%, Water Resistance, Non Combustible as per BS:476 Part-4, Fire Performance: Fire Propagation as per BS:476 Part-6, Class-1 for Surface Spread of Flame as per BS:476 Part 7, Class A or Class 1 as per ASTM E 84, Thermal Conductivity K= 0.048 to 0.052 w/m K as per ECBC code 2007, Size of the tile is 595x595mm, Density of tile should be 450 kg/m3 density all around on edge resting portion and 350kg/m3 density at the Quadrant, Light Reflectance > 85%, Weight of the tile is 5-5.5 kg/m2 and Suitable for Green Building application with InOrganic Recycled content of 50% and meets the GRIHA norms under the categories: GRIHA V.2015 criterion:11&12, GRIHA V.3 criterion: 17&29 and SVAGRIHA criterion:12. The tiles Shall be laid on 15mm wide Polyester Powder Coated Galvanized Iron (PPGI) Slimline Profile Black/White reveal T-Sections Flanges colour white having rotary stitching double webbed on all T sections. The framework shall comprise of Main T runner with a web height of 38mm and 1200mm & 600mm Cross Tees with a web height of 38mm having sheet thickness of 0.4mm. The T sections should have Galvanizing of 120 g/m2 and need to be installed with Suspension system consisting of 12x50mm long dash fastners, Z cleat 25x37x25x1.6mm with pre cut hole on both 25mm flange to accomdate the 6mm dia bolt of the fasterner on one flange and 6mm fully threaded hanger rod uptom 1000mm length on the other. L-shape level adjuster of size 76x25x1.6mm to be fixed with T grid main runner. The entire grid rests on the perphery on a pre	320	Sqm

	coated GI wall angle of size 15x20mm of sheet thickness 0.40mm of length 3000mm to be fixed on periphery wall/partition with the help of plastic rawl plugs at 450mm center to centerand 40mm long s.s screws. The work shall becarried out as per specifications, drawings and as per direction of Engineer in Charge.		
25.01	Repair to plaster of thickness 12 mm to 20 mm in patches of area 2.5 m2 and under, including cutting the patch in proper shape,raking out joints and preparing plastering the wall surface with white cement based polymer self curing mortar,including disposal of rubbish,all complete as per the direction of Engineer in charge.	1300	Sqm
26.01	Providing and applying white cement based putty of average thickness 1 mm of approved brand and manufacture,over the plastred wall surface to prepared the surface evenand smooth complete as per Specification andnas per direction of Engineer in charge	1300	Sqm
27.01	Wall painting with premium aceylic emulsino paint of interior grade, having VOC (Volatile Organic Compound) contentless than 50 Grams/litre of approved brand and manufacture,including applying additional coats wherever required to achieve even shade and colour .two coats as per Specification and as per direction of engineer in charge	1300	Sqm
28.01	Finishing walls with Acrylic smooth exterior paint of required shade :Old work (Two coat applied @1.67 1/10 m2)on existing cement paint surface including preparing the surface aftre thorughly cleaning the surface to remove all dirt,dust and foreign matter,cost of materials,labourcomplete as per specification and as per direction of Engineer in charge	1300	Sqm
29.01	Supply and installation of Tarpaulin canvas between the AC duct and AC evaporator unit including accessories.	253	Nos
30.01	Dismantling of existing indoor,outdoor,ducts,copper piping and shifting of the same as per direction of engineer incharge	1	Nos
31.01	Disposal of building rubbish / malba / similar unserviceable, dismantled or waste materials by mechanical means, including loading, transporting, unloading to approved municipal dumping ground or as approved by Engineering in charge to the appropriate disposal area.	100.00	cum
32.01	Dismantling aluminium/ Arcylic Sheet/Gypsum partitions, doors, windows, fixed glazing and false ceiling including disposal of unserviceable material and stacking of serviceable material to the appropriate disposal area as per direction of Engineer-in-charge.	480.00	sqm
33.01	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material to the appropriate disposal area as per direction of Engineer-in-charge.In cement mortar	300.00	cum
34.01	Providing Comprehensive Annual Maintenance Contract with three skilled technicians	2.00	year