



TENDER DOCUMENT
(e-Procurement)

Tender No: IISc/Tender-ELE-1/2022-23

For

“Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, 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**

Website : <https://IISc.ac.in/business-with-IISc/tenders/>

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1. Tender Notification

Tender No: IISc/Tender-ELE-1/2022-23

Scope of Work	Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, Bangalore
Estimated Value of work	Rs. 2,19,16,282.00
Period of Work Completion	4 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 2020/2202 e-mail: office.ccmd@iisc.ac.in
Tender Fee	As per e-procurement portal
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. 3,28,744.00
Last date and Time for online submission (uploading) of tender	26.05.2022 at 14:00 Hrs
Date and Time of opening of Tender (Technical Bid)	27.05.2022 at 14:00 Hrs
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	18.05.2022 at 14:00 Hrs 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

2. Notice Inviting Tender

The Registrar, Indian Institute of Science invites tenders in two bid (Technical and Financial) system from eligible Bidders, for **“Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, 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 certificate 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 in State / Central Govt. Departments / BBMP / PSU/ Central PSUs/ Autonomous bodies / Institutions are not eligible to quote, if found such tenders will be rejected. The contractors who are penalized due to delay in completion of the previous works 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 men and machinery within 10 days from the date of work order, 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 above specified minimum qualifying criteria, shall be eligible.
- 2.12 Even though the Bidders meet the above criteria, 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.

To give prospective Bidders reasonable time in which to take corrigendum/ addendum into account in preparing.

2.19 Documents comprising the Tender

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

- a) Earnest Money Deposit & Tender fee 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 hard copy 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 and Tender fee:

The Bidder shall furnish, as part of his tender, earnest money deposit (EMD) and tender fee. The Bidder has to pay the Earnest Money Deposit (EMD) and Tender fee 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 and tender fee 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, Small and Medium Enterprises (MSME):

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

Policy is meant for procurement of only goods produced and services rendered by MSMEs. 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 thro' 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 by e-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 2.31, 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 as per 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 Further Security deposit (FSD)

Further percentage on the running bills and final bill in addition to Earnest Money Deposit shall be levied from the contractor. When the FSD deducted from R.A Bills of the contractor @ **1.5%** 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 Scheduled Commercial 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 by a Scheduled Commercial 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.

3 Declaration of Tenderer

Name of Work: Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, 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 The bidder should have satisfactorily completed as a Prime contractor during the last seven years, ending March 2022 in PWD/CPWD/Railways/BSNL/MES//Central PSUs or any Government Department.
- a) Three similar works each costing not less than 40% (forty percent) of the estimated cost i.e. **Rs. 87,66,500** or completed two similar works each costing not less than 60% (sixty percent) of the estimated cost i.e. **Rs. 1,31,49,700** or completed one similar work costing not less than 80% (eighty percent) of the estimated cost i.e. **Rs. 1,75,33,000**.
- b) Work completion certificate for having completed work of similar nature of contract certified from the competent authority not below the Rank of Executive Engineer or equivalent shall be uploaded. The work completion certificate shall mention the nature of work, items of work executed, the agreement number & date, the value of work, the date of commencement, the stipulated date of completion, the actual date of completion of the work and reason for delay (if any).
- 4.2 The bidder should be either manufacturer or the authorized dealer of the Chiller makes mentioned in the tender document.

Financial Criteria

- 4.3 The bidder should have registered for a minimum period of Ten years.
- 4.4 The average annual financial gross turnover should be 30% of estimated cost in that last five years.
- 4.5 The minimum annual financial turnover for the two consecutive years should be 30% of estimated cost.
- 4.6 The bidder should have not incurred any loss in more than two years.
- 4.7 The bidder should submit the solvency certificate from the bank for 30% of estimated cost.
- 4.8 The average net worth of the bidder as of **2021-22** should be not less than 25% of estimated cost. Necessary certificate by the Chartered 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 = $A \times M \times N - B$, 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 of work	Place & State	Contract number & date	Name & address of the 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 Tenders already submitted:

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 Chartered Accountant stating turn over for the last five years is also to be uploaded.

Sl.No	Year	Turn over amount	Remark
1	2017-18		
2	2018-19		
3	2019-20		
4	2020-21		
5	2021-22		

Litigation and Arbitral Issues:

4.13 Net pending litigations should not be more than 50% of bidder's net worth.

4.14 No consistent history of court/arbitral award decisions against the bidder for the last five years.

5 Special Conditions

- 5.1 Establishment of Labour 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.
- 5.2 Any damage to the existing service lines during execution of work shall be got rectified by the bidder at his own cost and risk.
- 5.3 Debris shall be disposed-off to an undisputed place of Bangalore outskirts as per the direction of the Engineer-in-Charge, whenever required. If the item is not found in the Bill of quantities and the rate in the contract for haulage of debris, it shall be paid as per the KPWD SR.
- 5.4 Labor employed at the site will not be allowed to use cellphone while working at the site.
- 5.5 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.
- 5.6 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 1.50% of the value of the work.
- 5.7 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
- 5.8 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 / KPWD 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.
- 5.9 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.
- 5.10 The rates quoted shall be for finished work and shall include for all necessary incidental work. GST or any other taxes on materials/services in respect of this contract will be payable by the Contractor. The Contractors cannot presume any details regarding the contract.
- 5.11 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.
- 5.12 Tenders determined to be substantially responsive will be checked by IISc for any arithmetic errors. Errors will be corrected by the Employer as follows.
- 5.13 Where there is discrepancy between the rates in figures and in words, the lower of the two will be governed.

- 5.14 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.
- 5.15 Where there is a discrepancy in entries of unit rate between the Original and Duplicate, the lower will govern.
- 5.16 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.
- 5.17 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.
- 5.18 The contractor shall vacate the campus premises with all his men/ materials immediately after completion of the project.
- 5.19 The equipment data sheet as per the technical specification to be filled by the bidder and uploaded along with the technical bid eligibility documents.
- 5.20 These special conditions will have the overriding effect on any of the terms and conditions of the contract elsewhere included in the contract document repugnant to each other and in such events, only the condition on the issue, if any as in special condition shall only be applicable and prevails. In case of disputes in interpretation of any clause the decision of the Director of IISc is final thereof and binding.

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 and at 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 PROJECT PROGRAMME 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, labour cess 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 tenderer. 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 sub agencies 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 neighbor shall be minimized by providing and erecting screens to the required height as per direction of Project Engineer cum Estate officer with Aluminum 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 the site which does not interfere with the construction as determined by the Engineer-in charge.

6.85 **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.

6.86 **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.

6.87 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.

6.88 **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.

6.89 **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.

6.90 Labour Statistics:

The contractor shall submit daily reports on the following:

- (a) Total No. of labour employed in the working area.

6.91 Execution of work during nighttime:

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.

6.92 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.

6.93 AWARENESS OF SITE CONDITIONS AND CARRYING OUT OF SITE INSPECTION PRIOR TO TENDER SUBMISSION:

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.

6.94 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.

6.95 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.

6.96 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.

6.97 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.

6.98 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.

6.99 RATE ANALYSIS

At any time 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.

6.100 The Project Engineer 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 FINES 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 Fines:

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 FINES 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 15 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 thereof 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 6 months immediately preceding the date of delivery / miscarriage.

8 CONDITIONS OF CONTRACT

Clause 1. Security Deposit

Estimated cost of the work put to tender	E.M.D. Percentage	F.S.D. Percentage
(i)	(ii)	(iii)
Rs. 3,16,18,564	1.5%	1.5%
Note : EMD + FSD to be limited to 3.0% 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 FSD 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 + FSD will be limited to 3% of the contract value.

E.M.D - Earnest Money Deposit

F.S.D - Further Security Deposit

No Interest will be paid on EMD/ Further 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 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 a Scheduled Commercial Bank in favour of the Registrar, Indian Institute of Science, payable at Bangalore amounting to 3% of the total contract value valid up to 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 set off 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 & FSD):**

i) EMD paid by the contractor at the time of tendering and FSD 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 a Scheduled commercial 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 **twelve 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, whichever 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. PENALTY FOR DELAY

(f) 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.

(g) 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.

(h) 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 half percent of the contract value of the balance work assessed according to the programme, 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.

a) 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.

b) 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.

c) 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.

d) 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.

e) Recovery of 1% of the contract value towards the laborers welfare fund created by the Government of Karnataka will be effected in the running account bills of the contractor.

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

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 commensurate with its increase in cost occasioned 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. Contractor to submit bills monthly in printed form

- (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.

All bills shall be prepared in the prescribed printed and electronic form in PDF format in quadruplicate and handed 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. PAYMENT PROPORTIONATE TO WORK APPROVED AND PASSED.

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 :

- (i) 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.

(j) 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.

(k) 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.

(l) 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

- (i) 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: -
- iii) Increase or decrease the quantity of any work included in the contract.
 - iv) Omit any such work.
 - v) Change the character or quality or kind of any such work,
 - vi) Change the levels, lines, positions and dimensions of any part of the work,
 - vii) Execute additional work of any kind necessary for the completion of the works and
 - viii) 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

- (ii) 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.
- (iii) a) Any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor 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. TIME LIMITS UNFORSEEN CLAIMS

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 any time 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 thereupon suspend or stop the work totally or partially as the case may be. In any such case, except as provided hereunder, the contractor shall have no claim to any payment of compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in 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 that he 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 materials 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:

- (i) One qualified Graduate Engineer & One qualified Diploma Engineer, when the cost of the work to be executed up to 1 Crore,
- (ii) Two qualified Graduate Engineer & Three qualified Diploma Engineer, when the cost of the work to be executed from 1 Crore to 10 crores;
- (iii) Three qualified Graduate Engineer & Six qualified Diploma Engineer, when the cost of the work to be executed above 10 crores;
- (iv) 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.

The technical staff so employed, should be available at site whenever required by Engineer in-charge to take instructions.

- (c) 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.
- (d) 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 AFTER CERTIFICATE 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., AND IS LIABLE FOR DAMAGES ARISING FROM 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 black list 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 CONSIDERED AS REASONABLE COMPENSATION WITHOUT 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 herein before mentioned,**
- (ii) The quality of workmanship 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's decision 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. CONTRACTOR TO PAY COMPENSATION UNDER WORKMEN'S COMPENSATION ACT.

(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: -

- (i) 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.
- (ii) 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.
- (iii) Adequate provision shall be made for prompt first - aid treatment of all injuries likely to be sustained during the course of the work.

Clause 26. Minimum age of persons employed by

contractor (a): No contractor shall employ

- (i) Any person who is under age of 15 years.
- (ii) Who does not produce a valid certificate of vaccination against epidemic diseases in respect of 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 IN BORROW 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 duties 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:

- 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 areas, protection of workers working under elevated conditions, accident reporting, first aid provisions etc.

- 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.
- Attending weekly or as scheduled safety meetings at site conducted by the site safety representative of project manager
 - 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.
 - 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 32 Refund of Security Deposit (EMD & FSD):

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 33. PENALTY FOR DELAY

(a) Written Order to Commence Work

After acceptance of the tender, The Project Engineer cum Estate Officer, CCMD 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, CCMD. 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 to the agreement.

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

The Project Engineer cum Estate Officer, CCMD shall review the progress of all works with the contractor during the first fortnight of every month. Such a review shall take into account the programme fixed for the previous month, obligations on the part of the Contractor.

(d) 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, CCMD and the Contractor.

Clause 34 BAR 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 ---- day of ----- in the year -----
-----.

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**, (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 -----, 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 **"Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, Bangalore"** (hereinafter called the work) executed by the Contractor at the rates quoted by him amounting to **Rs. -----** (Rupees ----- only) inclusive of all Taxes which is -----% -----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

NOW THIS AGREEMENT WITNESSETH AND THE PARTIES HERETO AGREE AND SOLEMNLY 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 **4 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 proper 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 one-eighth of the whole work before, one-fourth of the whole time allowed under the contract has elapsed, three-eighths, of the work before one-half of such time has elapsed, and three-fourths of the work before three-fourths 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 seven and a half (7.5) 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. 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 Project Engineer-cum-Estate Officer, CCMD on behalf of the Director of the Institute shall have 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.
- (b) To employ labour paid by the Institute and supply materials to carry out the work or any part by debiting the Contractor with the cost of the labour 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.
- (c) 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, lawsuits, 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 aforementioned 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, lawsuits, 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 with 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 fulfil 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 party.

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.

24. **COURTS:**

Courts of appropriate jurisdiction situated in Bangalore City shall have exclusive jurisdiction

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

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

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.

MEMORANDUM OF WORK

1.	General Description	Supply, Installation, Testing and Commissioning of HVAC system at NSSC (TATA Auditorium) in IISc, Bangalore
2.	Estimated Cost	Rs. 2,19,16,282
3.	Earnest Money	Rs. 3,28,744
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 in every month.
6.	Further Security Deposit	1.5 % on the running account bills and final bill in addition to Earnest Money Deposit. When the F.S.D. deducted from the RA bills of the Contractor @ 1.5 % 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 Scheduled Commercial Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.
5.	Time allowed for the completion of work in all respects from the date of commencement of work	4 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 twelve 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 agree to abide by and fulfil 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 the sums of monies mentioned in the said conditions.

The sum of **Rs. 3,28,744 (Rupees three lakh twenty eight thousand seven hundred and forty four only)** has been deposited by demand 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 **xxth** day of **xxxxxx** 2022.

Signature of the Contractor

Witness to Contractor/s Signature:

NAME

ADDRESS

OCCUPATION

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

**REGISTRAR
INDIAN INSTITUTE OF SCIENCE
BANGALORE.**

10. REFERENCES

I.S. STANDARDS OF ELECTRICAL WORKS

Sl.No	STANDARDS	TITLE
	Code of Practice / Guide	
1	IS : 732 – 1989	Code of Practice for Electrical wiring installations.
2	IS : 4648 – 1968	Guide for Electrical layout in residential buildings
3	IS : 80614 – 1976	Code of Practice for Design, installation and maintenance of service lines up to and including 650V.
4	IS : 7752 (Part-1) - 1976	Code of Practice for interior illumination : General requirements and recommendations for welding interiors.
5	IS : 4347 – 1967	Code of Practice for hospital lighting
6	IS : 6665 – 1972	Code of Practice for industrial lighting
7	IS : 2672 – 1966	Code of Practice for Library lighting
8	IS : 10118 (Part-1) - 1982	Code of Practice for selection, installation and maintenance of switcher and Control gear : Installation.
9	IS : 4146 – 1983	Application guide for voltage transformers.
10	IS : 3043 – 1987	Code of practice for earthing.
11	IS : 5216 (Part-2) - 1982	Guide for safety procedures and practices in electrical work : General.
12	IS : 4237 – 1982	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC.
13	IS : 6875 - (Part-1) - 1973	Control switches (Switching devices for control and auxiliary circuits including 1000 V AC and 1200 V DC : General requirements and tests.
14	IS : 10027 – 2000	Composite units of Air-Break switches and rewirable type fuses for voltages not exceeding 650 V AC.
15	IS : 4064 (Part-1) - 1978	Composite units of Air-Break disconnecter, Air-Break switch disconnecter and fuse- combination units for voltages not exceeding 1000 V AC or 120 V DC : General requirements.
16	IS : 8828 – 1996	Electrical accessories - circuit breakers for over current protection for household and similar installation.

17	IS : 2516 (Part-1/Sec01)-1985	Circuit-Breaks : Requirements and tests : Voltages not exceeding 100 V AC or 1200 V DC.
18	IS : 5039 - 1983	Distribution pillars for Voltages not exceeding 1000 V AC or 1200 V DC.
19	IS : 8544 (Part-4) - 1979	Motor starters for voltages not exceeding 1000 V : Reduced voltage AC starters, two- step auto transformer starters.
20	IS : 9537 (Part-1) - 1980	Conduits for electrical installations General requirements
21	IS : 9537 (Part-4) - 1983	Conduits for electrical installations : Pliable self recovering conduits of insulating materials.
22	IS : 3854 - 1997	Switches for domestic and similar purposes.
23	IS : 1293 - 1988	Plugs and sockets outlets of rated voltage up to and including 250 Volts and current up to and including 16 Amperes.
24	IS : 2418 (Part-1) - 1977	Tubular Fluorescent lamps for general lighting services : Requirements and tests.
25	IS : 9900 (Part-1) - 1981	High pressure mercury vapor lamps : Requirements and tests.
26	IS : 1913 (Part-1) - 1978	General and safety requirements for luminaries : Tubular fluorescent lamps.
27	IS : 10322 (Part-1) - 1982	Luminaries : General requirements
28	IS : 302 (Part-1) - 1979	General and safety requirements for household and similar electrical appliances.
29	IS : 6236 - 1971	Direct recording electrical measuring instruments.
30	IS : 2705 (Part-1) - 1992	Current transformers : General requirements.
31	IS : 2448 (Part-1) - 1963	Adhesive insulating tapes for electrical purposes : Tapes with cotton textile substrates.
32	IS: 8130-1984	Code for Conductor Construction
33	IS: 5831-1984	Code for Insulation & sheath material

34	IS:694-1990	PVC insulated Flexible Single Core Wire/ Unarmoured Multicore/ Flat Cables. For working voltage upto & including 1100V.
35	IS:1554(Part-1)-1988	Copper or Aluminium Conductor, PVC insulated, extruded inner sheathed PVC, galvanised steel wire/strip armoured, extruded PVC sheathed LT Control/Power Cable. For working voltage up to & including 1.1KV.
36	IS:3975-1990	Code for Number of Strips in armouring construction.
37	IS: 7098/II/85	XLPE insulated HT & AB Cables. For working voltage 6.35/11KV.
38	IS:14255-1995	Code for Aerial Bunched Cables.For working voltage up to 1.1KV.
39	IS:13573/VDE 0278/IEC 60502/HD 629.1.S2 CENELEC	Code of Type tests for HT termination jointing kit.
40	IS 7569:1987	Cast Acrylic Sheets for use in Luminaires
41	IS 8030:1976	Specifications for Luminaires for Hospitals
42	IS 10242: Part 3: Sec 6: 1986	Electrical installations in ships: Part 3 Equipment, Section 6 Luminaires & accessories
43	IS 10322: Part 2 1982	Specification for Luminaires - Part 2: Constructional Requirements
44	IS 10322: Part 3 1984	Specification for Luminaires - Part 3: Screw & Screw Less Terminals
45	IS 10322: Part 4 1984	Specification for Luminaires - Part 4: Method of Tests
46	IS 10322: Part 5: Sec 1: 2012	Luminaires: Part 5 Particulars requirements, Sec 1 General Purpose Luminaires
47	IS 10322: Part 5: Sec2: 2012	Specifications for Luminaires - Part 5 : Particular Requirements - Section 2: Recessed Luminaires
48	IS 10322: Part 5: Sec4: 1987	Luminaires: Part 5 Particulars requirements, Section 4 Portable general-purpose luminaires

49	IS 13383: Part 1 : 1992	Photometry of Luminaires - Method of Measurement - Part 1: Luminaires for use in interior Lighting
50	IS 13383: Part 2 : 1992	Methods of Photometry of luminaires: Part 2 Luminaires for road & street lighting
51	IS 13383: Part 3 : 1992	Photometry of Luminaires - Method of Measurement - Part 3: Luminaires for Floodlighting
52	BSEN 10025 Grade 5, 355JO (or) ASTM A 572-50	Steel sheet thickness
53	IS 875 Part 3	Wind Velocity
54	IS 2062 (or) ASTM A 572-50	Base Plate
55	BSEN ISO 1461 (or) ASTM A123 (or) IS 2629	Galvanized in single hot dip / With Average 70 Microns
56	BS 5135	Welded Single L-Seam Joint
57	AISI 304 Grade	Stainless Steel Wire Rope (Factor of Safety: TR No. 7)
58	IS 1239	Maximum Load Carrying Capacity (Lantern)
59	IS 9595 (or) IS 10178 AWS	Single Section & Single Joint welded
60	ASTM - A 123 and 153	Hot dip Galvanized in Single dipping with not less than 65 Microns

11. TECHNICAL SPECIFICATION

The work shall be carried out as per CPWD / KPWD Specification and relevant IS codes. In case of discrepancy between technical specification and BOQ, the BOQ prevails.

SYSTEM DESCRIPTION

COMFORT AIR CONDITIONING.

The Air Conditioning system is designed considering the latest standards and codes like American Society of Heating, Air Conditioning and Refrigeration Engineers Standards, (ASHRAE) and Indian Society of Heating, Air Conditioning and Refrigeration Engineers Standards. (ISHRAE)

The Air-conditioning of **J N TATA AUDITORIUM** and **Seminar Hall A,B,C** shall be with chilled water AHU connected to an Air cooled chiller as described in the BOQ.

POWER SUPPLY:

Power shall be made available at 415 V 3 phase / 230 V single phase, 4 wire, 50 HZ earthed neutral system and all equipment shall be suitable for the above power supply with variation of + / -10 %. All equipment shall operate at this voltage and any equipment operating at other than this power supply shall be provided with necessary transformer.

CODES AND STANDARDS:

The installation shall conform in all respects to, the following broad certifying agency / standards apart from the specific equipment standards and specifications.

ASHRAE Standards

ASHRAE : 62.1 – Ventilation for acceptable IAQ

ASHRAE : 90.1 – Energy Standard for Buildings Except

Low – Rise Residential Buildings

ASHRAE 52 : Air Cleaning Devices Used in General
Ventilation for Removing Particulate matter

ISHRAE : Weather Data

NFPA – 90 A : Installation of Air Conditioning and
Ventilation Systems

ARI : Cooling Coil ratings

AMCA : Fans

SMACNA : Sheet Manufacturers and Contractors
National Association.

In case of discrepancy among specifications, drawings and other documents, the specifications take precedence over all other documents. In case of discrepancy between specification, drawings etc and codes & Standards, the tenderer shall assume the more stringent of the two.

DRAWINGS, SPECIFICATIONS AND DEVIATIONS.

The drawings and specifications lay down minimum standards of equipment and workmanship. Should the tenderer wish to depart from the provisions of the specifications and drawings either on account of manufacturing practice or for any other reasons, he should clearly draw attention in his tender to the proposed points of departures and submit such complete information, Drawings and specifications will enable the merits of the deviations to be fully appreciated. In the absence of any such deviation list, it will be deemed that the tenderer is fully satisfied with the intents of the specifications and the drawings and their compliance with the statutory provisions and local codes. All deviations or departures not brought out to the notice shall be disregarded.

TOOLS AND SPARE PARTS.

All the tools and tackles, scaffolding and staging required for erection and assembly of the installation covered by the contract shall be obtained by the contractor himself and shall meet the EHS requirement. All other material such as foundation bolts, nuts etc, required for the installation of the plant shall be supplied and included in the contract.

Tenderer shall include spares recommended by him for two years operation for each type of equipment covered by the specification.

SHOP DRAWING, INSPECTION AND TESTING

Working and construction drawings

The contractor shall prepare shop drawings and all work shall be according to approved working drawings. Shop drawings shall give all dimensions and shall incorporate the requirements of the Client. Approval of drawings does not relieve the contractor of his responsibility to meet the intents of the specifications. All such drawings for approval shall be submitted in 6 copies for Client. In addition, the contractor shall submit manufacturer's details and get them approved before ordering. This has to be done whether the materials / equipment is one of the approved makes or not.

Testing and Inspection

The contractor shall carry out tests on different equipment and system in total as specified in various sections of the tender in the presence of Client in order to enable them to determine whether the plant, equipment and installation in general comply with the specifications. All equipment shall be tested after carrying out the necessary adjustments and balancing to establish equipment ratings and all other design conditions. The test data shall be submitted in Acceptance Test Form.

Calibration of instruments and meters

The contractor for testing with initial requirements of all consumables shall furnish instruments required for testing. All the instruments, meters etc to be used at site and on the system shall have a valid calibration certificate issued by the competent authority. The contractor shall maintain and make available all such calibration certificates.

Handing over requirements

The plant shall be handed over after satisfactory testing along with following documents.

1. Detailed equipment data in the approved Performa.
2. Manufacturer's maintenance and operating instructions
3. Set of as built drawings, layouts, piping, ducting, cable routing, cable schedules etc
4. Approved test readings of all equipment and installations
5. Inspection certificates
6. Certificates of approval from statutory or Local Authorities for the operation and maintenance of the installations.
7. Wherever such approval or certification is required. This shall include Application filed along with enclosures and receipts of fees paid and deposits made.
8. List of recommended spares
9. Certificate from the contractor that he has cleared the site of all debris and litter caused by him without violating the EHS norms during the construction. However, contractor has also to periodically clear the site from all the debris, which is generated from his part of scope.
10. Undertaking that all the materials supplied by him at site are fully tax paid and shall produce all documentation for satisfaction of Client or taxation authorities.

Submission of the above documentation shall form a precondition for final acceptance of the plant and installation and final payments.

Statutory approvals inspection

The contractor shall be fully responsible for meeting all the statutory obligations and local inspectorates wherever applicable to the works carried out by them. The contractor should prepare all working drawings and obtain approval of competent authorities and also have the equipment and installation inspected and got approved. All the original receipts of official fees paid, and deposits made against the demand in writing from the appropriate authority shall be submitted to the Client.

SCOPE

The HVAC Contractor is expected to study the site conditions regarding ambient, seismic, geological & metrological data & ensure that the entire system supplied has been designed & manufactured to suit the same

SCOPE OF WORKS FOR HVAC SYSTEMS.

Major works.

1. Preparing shop drawing and working out the Actual final requirement of the system.
2. Procurement of Equipment as per the tender technical specifications and as per the schedule given by the Client.
3. Design of the sheet metal ducting based on the data furnished in the document.
4. Procurement of materials as per BOQ of the tender document.
5. Manufacturing as per standards & details furnished in the specifications
6. Assembly
7. Testing in Shop before delivery
8. Inspection
9. Insurance up to handing over
10. Packing & Forwarding
11. Transportation
12. Installation at Site as per the schedule given by Client/ Project Managers
13. Submission of method statements for execution
14. Testing, System balancing and Commissioning in the presence of specialized agency (manufacturer's representative)
15. Performance Guarantee run
16. Handing over

WORKS NOT INCLUDED FOR HVAC SYSTEMS

Associated civil works like :

Dismantling of existing false ceiling

RCC / PCC Pedestals required for all air conditioning equipment like Chiller installation shall be executed by the Civil Contractor.

Coordination with other subcontractors with regard to installation of items not in Air Conditioning contractor's scope.

HVAC contractor should quantify & provide necessary details, detailed working drawings with dimensions, operating weight to the civil contractor for execution after obtaining the approval on the shop drawing from the consultants.

PREPARATION OF EXECUTION DRAWINGS AND AS BUILT- DRAWINGS.

The contractor shall produce the Client, work drawings indicating all cut-outs to be left open, sleeves to be provided. The extent of work services under the contract includes all items shown on the drawings, indicated in companion with

specifications, notwithstanding the fact that such items have been omitted from the BOQ. All equipment and services, which are required to complete the intent of the contract, shall also be deemed to be within the scope of the contract.

SCOPE OF SUPPLY

Supply of various equipment as per the relevant Specification & Drawings, unloading, receiving, inspection, storing, transportation to work site, handling, assembling, cleaning, mechanical erection, assisting main contractor in associated civil works which are required for HVAC system, Installation, alignment, testing and commissioning and handing over in working condition of all items covered below but not limited to it:

1. Air cooled screw/Reciprocating chiller with R-134a refrigerant
2. Chilled water pumps.
3. Air handling units with chilled water-cooling coil
4. Chilled water piping with necessary fittings, valves, and insulation etc.
5. Sheet metal ducts fabricated to meet SMACNA standards.
6. Volume control dampers, Fire dampers etc.,
7. Grilles & Diffusers.
8. Painting and finishing work as per the standard specification.
9. Thermal and Acoustic insulation as specified.
10. Associated HVAC Electrical Works.
11. Any other items required for successful functioning of the system whether specifically

mentioned or not.

AIR COOLED CHILLERS.

GENERAL

The scope of this section comprises the scope, design, supply, materials, installation, testing and commissioning of the Air-Cooled Screw/Reciprocating chiller conforming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities.

SCOPE

The scope of the contractor not limited to but inclusive of Selection, Packing, Supply, installation, testing and commissioning of Air cooled chillers comprising Single/multiple screw/Reciprocating type compressors, stepped capacity control, / DX/Flooded type shell and tube cooler/PHE Type/ evaporator with closed cell elastomeric insulation, air cooled condensers, fans, Motors, Mounting frame, Gaskets, Spring type Vibration isolators, protection guard for condenser coils, necessary chilled water connection, Victaulic couplings, Hydronic kit, expansion tank, non-return valve, 3-way flow control valve, Equipment electrical panel, water flow switches, Transporting, Lifting to the point of installation, installation, testing, commissioning etc., as per the Indian & International standards etc., The tender cost should be inclusive of all above requirements. If required to the client all the units should be provided with manufacturer test certificates. The supplier should arrange for the necessary factory inspection in case the project needs. The additional cost of the test & inspection if any shall be borne by the client.

CODES & STANDARDS.

The design, materials, manufacture, inspection, testing and performance of the Chiller shall comply with all currently applicable statutes, regulations, codes and standards in the locality where the equipment is to be installed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility. In particular, the Chiller shall conform to the latest edition of the following standards:

AHRI 550/590 : Performance Rating for Air cooled Chilling Packages using the vapour compression cycle Eurovent Certification for Air cooled chilling package using the vapour compression cycle.

AHRI 575: Method of Measuring Machinery Sound within an Equipment Space

ASHRAE 15: Safety Code for Mechanical Refrigeration

ASHRAE 90.1: Energy Standards for Building except Low Rise Residential Buildings

ASME SEC 8 : Boilers and Pressure Vessel Code

NEMA MG1 : Motors and Generators

UL 1995: Safety of Cooling & Heating Equipments

NFPA 90 A: Installation of Air-Conditioning and Ventilation Systems.

ECBC 2007 : Table 5.1 – Minimum Equipment Efficiencies

QUALITY ASSURANCE.

Construct, test and rate chiller performance in accordance with AHRI 550/590-2011 with exceptions as noted in this specification. Construct, install and operate chillers in accordance with ANSI/ASHRAE 15- Safety Code for Mechanical Refrigeration and COMM 45 Wisconsin Mechanical Refrigeration Code. Construct and test chillers in accordance with ASME SEC 8. Construct and label chillers in accordance with UL 1995.

DELIVERY STORAGE & HANDLING.

Unit shall be Shipped / Transported, in accordance with manufacturer's instructions. The equipment should be properly packed by the manufacturer before the shipment to protect against any possible physical damage, weather.

The unit shall be without any physical damage from the factory leaving to until the installation. (Wherever the chiller installation by the separate mechanical contractor, The Equipment manufacturer is responsible for coordinating with the mechanical contractor for proper unloading, storing, lifting, installation, testing & commissioning of the same.)

Unit shall be shipped with all refrigerant piping and control-wiring factory installed.

Unit shall be shipped charged with oil and full charge of refrigerant. If the refrigerant charging is separate from the machine, then the refrigerant charging to be done by the manufacturer / HVAC contractor at the site.

The unit shall be handled & stored in accordance with the manufacturer's instructions.

The condenser coils shall be protected with PVC / plywood sheets till the time of commissioning of the chiller.

GENERAL SELECTION CRITERIA.

The Chiller shall be factory fabricated & assembled. All coils shall be rated, tested, and certified in accordance with AHRI standards.

The Chiller shall be selected for Actual cooling capacity as per the design condition & location given. The chiller shall meet the requirements of AHRI standards and ASHRAE

standard 90.1

The chiller shall meet the Efficiencies at 100% load and also at part load as prescribed in the BOQ. The Chiller should be of Low noise & Low sound pressure level.

The Chiller foot print shall not exceed the dimensions captured in the tender drawings.

The Chiller shall be using refrigerant of Eco friendly and CFC free type.

The Chiller shall be with Energy Efficient compressor and motor only. The Chiller shall be with high C.O.P only.

The Chiller shall be of less / minimum vibration type.

The Chiller shall be with necessary hardware & software suitable for the BMS operation with necessary provision for the two-way communication.

SUBMITTALS.

General arrangement (GA) drawings of the Chiller equipments with parts details, static & operating weight & point load details. The catalogue, operation & maintenance manual, wiring diagram etc.

Detailed technical data sheet of the Chiller.

Chiller Actual C.O.P & IKW/TR value at the maximum design load conditions.

Chiller performance details, Integrated Part Load Value (IPLV) in IKW/TR as per AHRI standards at the rated design flow and inlet and outlet water temperature including all accessories.

Equipment Sound power level in dbA and Sound pressure level in dbA @ 1.5m distance from the equipment at different octave band spectrum from 63 Hz to 8 kHz. etc.,

Water pressure drops in the cooler. Air pressures drop in the condenser. Type & details of Refrigerant used.

Details of Hydraulic kit.

Details of the Electrical characteristics.

Details of the power cabling requirements.

Chiller fan vibration balancing reports.

Factory performance test certificates.

CHILLER CONSTRUCTION DETAILS.

GENERAL:-

The chiller package shall consist of factory assembled liquid chiller shall comprise single/ multiple screw/Reciprocating compressor, motor, Compatible and fitted with VFD for Capacity Control. lubrication system, insulated cooler, air cooled condenser, condenser fan and motors, Refrigerant pipe & fittings, Spring type vibration isolators, Necessary chilled water flange connection with

Victaulic couplings, Refrigerant flow control devices (electronic expansion valves for DX type coolers), service valves, strainers, Antifreeze thermostat, liquid moisture indicators, First charge of refrigerant & oil, 2 way flow control valve, expansion tank, non-return valve, Electrical Starter panel and microprocessor control system, and documentation required prior to start-up. The compressor motor starters can be mounted on the chiller, wired, and tested by the chiller manufacturer. The total Equipment body shall be painted with one coat of Epoxy primer and two coat of Epoxy paint. Unit shall be suitable for operating at coastal weather conditions.

Unit shall be with firmly attached name plates to the major components indicating the name of manufacturer, chiller type & model number, Compressor type & model number, Type of cooler & condenser, Type of refrigerant used, Weight of refrigerant to be charged for the operating conditions etc.,

All the components being mounted on robust constructed welded steel frame structure; the frame structure, structural profiles, base frame & panels made of galvanized sheet steel (GSS) shall be protected with primary coating & finished with acrylic paint. The machine shall be mounted on vibration isolators. The package shall be suitable for outdoor installation; in other words, no weather protection of any kind by way of wall or roof is contemplated.

The Chiller shall be with VFD Compatible, necessary hardware & software suitable for the BMS operation with necessary provision for the two-way communication.

POWER SUPPLY:-

The Chiller unit shall be suitable for the 415V-3phase, 50 Hz -4wire system. The unit should be suitable for operation through remote control BMS system. The Micro processor panel shall be mounted on the equipment.

REFRIGERANT:-

The unit shall be suitable for Eco-friendly, CFC free refrigerant like R134a. The units should be first charged with refrigerant before shipping or shall be charged at site by the manufacturer. The equipment name plate shall be with type of refrigerant used, Weight of refrigerant to be charged for the operating conditions.

AIR COOLED CHILLER PERFORMANCE:-

Chiller should be selected for high COP value 3.3 as per AHRI-550/590 standards as defined in ASHRAE 90.1 and as per ECBC Table 5 for minimum equipment efficiencies.

OPERATING SOUND PRESSURE LEVEL:-

The unit shall operate at full load and all part load conditions without exceeding 70 db A sound pressure level at 1.5m distance. Required necessary attenuation devices should be included in the

cost of the chiller. The sound level shall be measured as per latest version of AHRI-575 standards. The sound pressure levels in all octave bands must be met as scheduled for full load and part load conditions.

COMPRESSOR:-

Screw/Reciprocating compressor compatible with VFD Operation of the high performance.

The compressor motor unit shall be accessible semi-hermetic direct drive, rotary screw compressor suitable for use with refrigerant R134.

All sensors shall get quickly disconnected to allow replacement of the sensor without replacement of the entire sensor wire. Pressure transducers shall be capable of field calibration to ensure accurate readings and to avoid unnecessary transducer replacement. Transducers shall be serviceable without the need for refrigerant charge removal or isolation.

It shall be complete with suction and discharge shut-off valves, relief valve, suction filter, muffler, dual manual reset type pressure state, refrigerant suction and discharge pressure gauges, crank case heaters and relays, direct coupled motor. The compressor shall incorporate automatic capacity control feature.

The unit shall be provided with slide valve unloading for partial load operations. The compressors shall have reducing capacity down to minimum 30% of full load condition. Motor shall be suction gas-cooled, semi-hermetically sealed, two poles, squirrel cage induction type. Further, compressors should be in unloaded condition during starting.

COOLER:-

Cooler shall be having shell and tube Flooded/DX/PHE type construction.

Units shall be fabricated with high-performance tubing, minimum 6mm thick steel shell and tube sheets with fabricated steel water boxes.

Water box shall be nozzle-in-head Water box (150 psig). Water box shall have standard Victaulic grooves.

Water boxes shall have vents, drains, and covers to permit tube cleaning within the space shown on the drawings. A thermistor type temperature sensor with quick connects shall be factory installed in each water nozzle.

Tubes shall be individually replaceable from either end of the heat exchanger without affecting the strength and durability of the tube sheet and without causing leakage in adjacent tubes.

Tubing shall be copper, high-efficiency type, with integral internal and external enhancement

unless otherwise noted. Tubes shall be nominal 10mm. OD with minimum wall thickness of 0.64mm measured at the root of the fin at the enhanced areas and minimum wall thickness of 1.25mm where the tubes are in contact with the end tube sheets unless otherwise noted.

Tubes shall be rolled into tube sheets and shall be individually replaceable. Tube sheet holes shall be double grooved for joint structural integrity.

Cooler shall be designed to prevent liquid refrigerant from entering the compressor. Devices that introduce pressure losses (such as mist eliminators) shall not be acceptable.

A reseating type pressure relief valve shall be installed on each heat exchanger. If a non-reseating type is used, a backup reseating type shall be installed in series.

Design, test & stamp the refrigerant side for minimum 400psig and the water side for 150psig working pressure.

AIR COOLED CONDENSER & CONDENSER FAN:-

The condenser coil shall be made out of seamless copper tube with aluminium fins. The coils shall be sized so as to optimize the performance with respect to airflow rate, pressure drop, condensing temperature, power consumption, etc. Thus the values furnished for the parameters of the coil in the Schedule of Equipment shall be regarded as suggested values rather than specified values.

The condenser coils shall include sub-cooling circuits.

The condenser coils shall be designed to limit the system charge to the minimum. However, if the condenser does not have adequate capacity to hold the entire charge in the system, receivers shall be provided. If receivers thus become inevitable, it must meet the following requirements:

Receivers shall be tested for the same pressure as the condenser.

The capacity of the receivers shall be adequate to hold the charge of the system when filled up to only 80% of its capacity. The condenser coils shall be tested for a minimum pressure of 30 kg/sq.cm. In the field, they shall be tested to a pressure of not less than 21 kg/sq.cm.

The condenser coils shall be provided with protective weld mesh to protect the fins from damage.

The air-cooled condenser shall incorporate necessary number of Low noise, direct drive, and aerofoil blades propeller fans of adequate size to obtain the required airflow rate under operating conditions. The fan shall be balanced both statically and dynamically. The fan motor shall be of TEFC squirrel cage construction and with IP-65 protection. Wherever condensers with discharge of hot air in the vertically upward direction are involved, special care must be taken to ensure that the fan motors are suitable for such service. The motor shall be suitable for outdoor installation and also for location in the stream of hot air leaving the condenser coil. The fan motor sets shall be

complete with protecting guards. Condenser fan shall be individually replaceable.

REFRIGERANT FLOW CONTROLS:-

To improve part load efficiency, liquid refrigerant shall be metered from the condenser to the cooler using an electronic expansion valve to maintain the proper liquid level of refrigerant in the heat exchangers under both full and part load operating conditions

INSULATION:-

Insulation shall be done with not less than 19mm thick closed cell elastomeric class 'O' foam insulation of density more than 60kg/m³, Thermal conductivity not more than 0.038W/m °C, The insulation shall be self-extinguishing type and suitable for outdoor weather condition. It should have good chemical resistance and no fungal growth. The insulation shall be done for the Cooler shell & head, Refrigerant pipe suction line, Motor housing & cooling lines for hermetic compressors and all lines & items surface temperature is less than 65DegF or colder.

STARTER PANEL.

The Micro processor panel with fully operating Micro processor controller in a lockable steel control panel suitable for outdoor application with minimum of IP65 class of protection. The panel shall incorporate main disconnect switches, for individual motors, contactors, over load relays, earth leakage relays, single phase preventers, phase loss protection, phase reversal protection, phase imbalance protection, under/ over voltage trip, required voltage transformers, on/off push buttons, auto manual switches to facilitate automatic operation or for manual operation. The disconnect switches provided shall be suitable for terminating copper cables.

INSTALLATION and START UP.

The chiller manufacturer shall provide a factory-trained representative, employed by the chiller manufacturer at the time of installation to do the installation or to monitor the installation and to perform the start-up procedures as outlined in the Start-up, Operation and Maintenance manual provided by the chiller manufacturer.

Manufacturer shall supply the following literature:

- a. Start-up, operation and maintenance instructions.
- b. Installation instructions.
- c. Field wiring diagrams.
- d. One complete set of certified drawings.

Functional Testing

Tests shall be in accordance with AHRI 550/590. NPLV method shall be used for nonstandard conditions.

The manufacturer's service technician shall provide initial start-up of the chillers in client presence.

Inspect all piping and electrical circuits. Provide and charge the machines with initial refrigerant and oil charges. Perform initial start-up of the chillers, measure and adjust water flows through the machine components for proper operation of the system, and complete other functions normally associated with start-up. Perform operating checks on all operating and safety controls. Calibrate all integral controls, gauges, and thermometers, as well as all field-mounted controls furnished with the chiller. Provide required programming and setup of the required hardware / software assistance to the BMS vendor for software integration. Before starting the chiller, confirm that the remote starters have been field checked and certified in writing by an authorized factory service representative.

During initial run testing of the chillers, provide support for the starter-authorized factory service representative to re inspect the starters to ensure that the devices are operating correctly, all electrical connections are tight and secure, and that the ammeter is properly calibrated. In addition, check for proper loading and perform all calibrating procedures on the motor overload relays to match the cut-out points with the requirements of the chiller motor. Verify the equipment operates as designed, and rectify all deficiencies. Perform an oil analysis after 2000 hours of operation.

ENERGY EFFICIENCY REQUIREMENTS (General Guidelines).

The Manufacturers are requested to offer their high-energy efficient model Chillers for this project tendered. The energy efficiency of the chiller to be rated based on AHRI 550-590-98 standards or latest class of standards. The penalty clause shall be applicable as per the clause mentioned above if the chiller is not meeting the rating value confirmed by the manufacturer. AHRI STANDARD 550/590-98 – RATING METOHD (IPLV & NPLV) Standard for Water Chilling Packages using the Vapour Compression Cycle.

Evaporator Fouling Factor Allowance.

Recently completed research work sponsored by ASHRAE shows that actual fouling of the waterside of closed circuit evaporators of water chillers is considerably less than the allowance currently contained in the Standards. The details of these studies are contained in two ASHRAE papers listed in the appendix (3) & (4). The results are further summarized in AHRI Guideline E-1997 (5). In the work associated with these studies, several experimental tests were run with various combinations of clean water, dirty water, different tube types, and 3 ft/sec. and 7 ft/sec. water velocities. The tests indicated that even in the worst case, the level of fouling after extended operation was less than 11.6% of the standard practice of using 0.00025 h.ft².°F/Btu of FF. This indicates that for closed circuit evaporators, the 0.00025 h.ft².°F/Btu of FF is overly conservative and is counter to the efforts to improve operating efficiency of chillers. An evaporator fouling factor allowance of 0.0001 h.ft².°F/Btu of FF is more appropriate for most closed loop circuits. As a result of these studies the standard fouling factor allowance on the waterside of closed circuit evaporators for centrifugal, screw, reciprocating and scroll compressor water chillers covered by

AHRI Standard 550/590, and absorption chillers covered by AHRI Standard 560 are being changed to 0.0001 h.ft².°F/Btu of FF.

AIR COOLED SCREW/RECIPROCATING CHILLER REQUIREMENTS			
SL.NO	DESCRIPTION	PROJECT DESIGN	
1	Type of Chiller	Air Cooled	
2	Type of Compressor	Screw/Reciprocating	
2	CAPACITY – TR & Qty	Not less than 80TR – 2 Nos.	
3	Refrigerant	R-134a	
4	IKW/ TR - COP as per Site Conditions @100% load	1.06 to 1.3	
5	Cooler Entering Water Temperature - deg F / deg C	54	12
6	Cooler Leaving Water Temperature - deg F / deg C	44	7
7	Cooler - Flow Rate – USGPM	192	
8	Cooler - Minimum Flow Rate – USGPM	50	
9	Cooler Fouling Factor - Hr FT ² DegF / BTU	0.0001	
10	Cooler Pressure drop –kPao f W.C. (Max)	50	
11	Condenser Entering Air Temperature - deg F	95	
12	Input Kw per Chiller unit @ 100 % load as per site conditions Including fans	105	
13	No. of Compressors	1-2	

END SUCTION CENTRIFUGAL TYPE CHILLED WATER PUMPS

SCOPE

This specification covers the supply, installation, testing & commissioning of End suction close coupled back pull out or Frame mounted flexible coupled Pumps. Chilled water pumps shall be of Constant flow type. End suction long coupled base mounted pumps are also acceptable.

CODES AND STANDARDS

The design, materials, construction, manufacture, inspection and performance testing of centrifugal pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility. The equipment supplied shall comply with the latest applicable Indian, American, British or equivalent standards.

DESIGN REQUIREMENTS

The total head capacity curve shall preferably be continuously rising towards the shut off. In case of unstable (drooping) characteristic the duty point shall be well away from the unstable region. The shut off head shall be at least 110% of the total head.

The required NPSH at duty point shall be at least 1.0 M less than the available NPSH.

Pumps shall run smooth without undue noise and vibration. The noise level shall be limited to 75 dBA at a distance of 1.8 M.

Vibration shall limited to class IIC of BS 4675 Part -I.

The Seismic capability of the pump shall allow it to withstand a horizontal load of 0.5g, excluding piping and/ or fasteners used to anchor the pump to mounting pads or to the floor, without adversely affecting the pump operation.

Motors shall be meet scheduled horse power, voltage, speed and enclosure design.

Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACT 92.

Pump shall be of maintainable design and for ease of maintenance should use machine fit parts and not press fit parts.

The pump vibration limits shall conform to Hydraulic Institute for recommend acceptable unfiltered field vibration limits for pumps with rolling contact bearings.

The power rating of the pump motor shall be the larger of the following:

- a) The maximum power required by the pump from zero discharge to zero head.
- b) 110% of the power required at the duty point.

Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division.

Components of identical pumps shall be interchangeable.

FEATURES OF CONSTRUCTION

All wetted Parts shall be made out of Stainless steel.

IMPELLERS:

The impellers shall be of bronze and the bearing assembly shaft shall connect to impeller.

Impeller shall be hydraulically and dynamically balanced and keyed to the shaft and secured by a stainless steel locking cap screw or nut.

The impellers on end suction pumps shall be fully enclosed type carefully balanced for smooth operation. Balancing openings shall be provided near hub of the impeller to reduce pressure on the stuffing box to approximately suction pressure.

WEARING RINGS:

Wearing rings are provided to maintain close running clearance and to minimize pressure leakage between suction and discharge chambers of the casing. The casing bearing rings shall protect the casing against wear and shall be locked in pump casing to prevent rotation.

Pump shall be provided with renewable type casing ring. Pump having capacity 2,000 cu.m/hr and above shall be provided with impeller ring in addition to casing ring. The hardness of impeller ring shall be 50 BHN higher than that of casing ring.

SHAFT:

The shaft shall be of high strength steel with optimum diameter to provide maximum strength with minimum shaft deflection. Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing box.

Stuffing box shall be of such design that it can be repacked without removing any part other than the gland and lantern ring. SHAFT SEAL:

The pump shall have mechanical shaft seals of extra hard carbon ceramic type. Details of the Mechanical seal provided shall be submitted with the Tender.

BASE PLATE:

Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area. The minimum base plate stiffness shall conform to ANSI /HI 1.3.4 – 1997 for Horizontal base plate design standards.

BEARINGS:

The bearing assembly shall have solid SAE1144 steel shaft. A Nonferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.

The bearing assembly shall support the shaft via two heavy duty regreaseable ball bearings.

Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreasable without removal of bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.

Labyrinth deflectors shall be provided to exclude dirt and moisture from the bearing housing. Grease reliefs shall be provided to prevent over-lubrication.

Bearings shall have a minimum life of 40,000 hours working.

COUPLING:

The Coupling shall be flexible type, centre drop out design coupler, capable of absorbing torsional vibration between pump and motor. Coupler shall allow removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. On Variable speed applications the coupler sleeve should be constructed of an EPDM material to maximize performance life.

Coupler shall be shielded by a dual rated ANSI B15.1, section 8 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.

All accessories required for proper and safe operation shall be furnished with pumps.

All incidental piping (including valves) required for sealing, lubrication and cooling for stuffing box packing and / or bearing of pump shall be furnished by the Contractor.

ALIGNMENT:

Pump and motors shall be factory aligned and shall be realigned after installation by the manufacturer's representative. The pump manufacturer shall provide certification to the effect that the pump and motor coupling has been carried out by them and checked by them.

On completion of the installation, grouting and connection of all piping, the pump and motor shall be rechecked for alignment by means of accepted methods, by the pump manufacturer/sole agent.

TESTS AND INSPECTION

A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the maximum discharge head or twice the rated discharge head, whichever is higher. While arriving at the above pressure, the maximum suction head shall be taken into account.

The hydrostatic tests on the casing shall be conducted for a minimum duration of 30 minutes.

Each pump shall be factory tested and name - plated before shipment.

PERFORMANCE TEST

Standard Running Test:

The pumps shall be tested as per IS 5120, at rated speed at SUB-Contractor's works to measure capacity, total head, efficiency and power. The negative tolerance on efficiency shall be limited to 2.5% (not 5 % as indicated in IS 5120. These tests shall form the basis for acceptance of pumps except for vibration and noise. The pumps shall be tested over the range covering from shut-off head to the maximum flow. The duration of the test shall be minimum one hour. Minimum five readings approximately equidistant shall be taken for plotting the performance curves.

NPSH Tests:

NPSH tests shall be conducted with water as the medium.

Mechanical Balancing

In addition to static balancing, impeller and balancing drum shall be balanced dynamically at or near the operating speed.

Field Testing

After installation, the pumps shall be subjected to testing at site also. If the field performance is found not to meet the requirements regarding vibration and noise as specified, the equipment shall be rectified or replaced by the CONTRACTOR, at no extra cost to the EMPLOYER.

TENDER DRAWINGS

The following documents/drawings shall be submitted by the CONTRACTOR along with their Bids:

Preliminary outline dimensional drawing of pump and motor. (Suction and discharge connections and foundation details shall also be indicated).

Performance curves (capacity vs total head, efficiency, NPSH and KW requirement) ranging from zero to maximum capacity. Pump Catalogues.

PAINTING

All ferrous surfaces shall be painted with one coat of red oxide primer paint followed by finish paint. However, the components of the pumps shall not be painted before inspection.

PUMP HEAD CALCULATION

It is very important that contractor shall submit actual pump head calculation based on site installation conditions taking into account the pressure drop in installed (to be installed) chillers, piping and fitting. This actual pump head calculation shall be submitted for engineer's approval before ordering equipment and motor. Required pump motor capacity will be provided based on actual head calculation without any extra cost.

TECHNICAL REQUIREMENTS FOR CHILLED WATER PUMPS

DATA SHEET

1 DESIGN FEATURES

1.1	Pump designation		Chilled Water Pumps
1.2	Design capacity	US GPM	192
1.3	Total head Primary/Secondary	Ft	65 / 80
1.4	Location		Outdoor
1.5	Maximum rated speed (at 50 Hz.)	RPM	1450
1.6	Liquid handled		Water
1.7	Quantity required		2 Each in Primary & secondary

2.0 FEATURES OF CONSTRUCTION

2.1	Type of pump		End suction back pull out
2.2	Impeller		Open/Enclosed/Non clog
2.3	Volute		Single
2.4	Shaft		Coupled
2.5	Drive Transmission		Direct
2.6	Seal		Mechanical seal
2.7	Coupling		Flexible
2.9	Prime Mover		AC Electric motor

3.0 MATERIALS OF CONSTRUCTION

3.1	Impeller		Bronze *
3.2	Casing		Stainless Steel

3.3	Shaft	Stainless Steel
3.4	Shaft Sleeve	SS
3.5	Impeller Ring	SS 304 *
3.6	Casing Ring	Cast Iron GR FG 200*
3.7	Mechanical Seal	Ceramic seal seat and Carbon seal ring
3.8	Base Plate	Fabricated Steel / Cast Iron*
	Note : For components marked * material test certificates shall be furnished	
4.0	ACCESSORIES	
4.1	Companion Flanges	Yes
4.2	Foundation Bolts	Yes
4.3	Base Plate	Yes
5.0	TESTING	
5.1	Hydrostatic Test	Witnessed
	Casing	
	Jackets / Cooling Passage	
5.2	Performance Test	Witnessed
	Std. Running Test	
	NPSH Test	

DATA TO BE FURNISHED BY THE CONTRACTOR AFTER AWARD OF CONTRACT AND BEFORE' INSTALLATION

1. Quality Assurance Plan (QAP)
2. Detailed dimensioned general arrangement drawing of pump and driver.
3. Foundation drawing of pump and driver with static and dynamic loads, details of fixing, grouting and all relevant data required for design of foundation
4. Cross-section drawing of the pump with complete part list, materials of construction and relevant standards for each part
5. Pump performance curves flow rate Vs head, BkW, efficiency, NPSHR from zero flow to maximum flow and torque-speed curve
6. Scheme for pump sealing, lubrication and cooling
7. Driver dimensional drawing
8. Surface preparation and painting procedures
9. Catalogues, data sheets and drawings for instruments
10. Installation, operation and maintenance manual
11. Isolation pads and SS or Hot dip galvanised foundation bolts provided by the Contractor.
12. Cork -rubber make metallic bellows shall be provided at suction and discharge.
13. Pressure gauges with needle valve provided at suction and discharge lines.
14. All accessories provided to complete the pump installation.

DATA SHEET

CHECK LIST AND PERFORMANCE TEST DATA TO BE PROVIDED AFTER INSTALLATION

No	Description	Unit	Time			Date			Remarks
			10.00	12.00	14.00	16.00	18.00	20.00	
1.	Suction pressure	Kg/cm ²							
2.	Discharge pressure	Kg/cm ²							
3.	Water flow rate	M ³ /hr							
4.	Current	Amps							
5.	Bed plate levels and alignment checks								
6.	Hydraulic test for casing at 1.5 times design Pressure								
7.	Noise level from pump	1.8m dB							
8.	Discharge Vs head	Mtr							
9.	Discharge efficiency Vs								
10.	Discharge Vs BkW								

Run Test shall be conducted on the Chilled Water Pumps.

INSPECTION:

Representatives from the Contractor and Engineer shall conduct a joint inspection of the Equipment. All

the discrepancies observed either incomplete works or defective work shall be clearly indicated in the joint inspection report. The mode of measurements given below is for the purpose of measurement and payment and the scope of works shall be as specified elsewhere in the specification.

Each pump set including motors, flexible connection at inlet and outlet, vibration isolators and accessories as specified in tender document shall be regarded as one unit for the purpose of measurement and payment.

DOUBLE SKIN AIR HANDLING UNITS (AHU) SCOPE

This specification covers the general design, materials, and construction features, delivery at site, handling at site, installation, testing, commissioning and carrying out performance test at site of Double Skin Air Handling Unit

CODES AND STANDARDS

The design, materials, manufacture, inspection, testing and performance of AHUs shall comply with all currently applicable statues, regulations, codes and standards in the locality where the equipment is to be installed. Nothing in this specification shall be construed to relieve the ACMV Contractor of this responsibility. In particular, the AHUs shall conform to the latest edition of following standards:

IS 7613	Methods of Testing Panel type Air Filters for Air Conditioning and Ventilation purposes.
ASHRAE 33	Methods of Testing – Forced Circulation Air Cooling and Air Heating Coils.
ARI 410	Forced circulation Air-Cooling and Air-Heating Coils.
ARI 430	Central-Station Air-Handling Units.
AMCA 210	Laboratory methods of Testing Fans for rating
FED STD 209E	Clean room and Workstation requirements, controlled environment.
NFPA 90A	Installation of Air-conditioning and ventilating systems.

CONSTRUCTION FEATURES TYPE

The AHUs shall be draw through type Horizontal floor mounted as specified. The unit shall comprise of various sections such as Pre-filters, cooling coil, fan, etc

CASING

The Air handling units shall be constructed using double-skinned acoustic panels with minimum 0.7 mm

thick pre-coated GSS sheet for outer skin and 0.7 mm plain GSS sheet for inner skin of the unit. All the panels shall incorporate 40 mm thick PUF insulation sandwiched in between inner & outer skin; The inner skins can be of perforated sheet in the case of Fan Sections to bring down the noise level. Entire inlet plenum should be acoustically lined with Mineral wool / fibreglass with perforated sheet.

The entire framework shall be mounted on a 100mm (minimum) aluminium alloy channel base. The panels shall be sealed to the framework by heavy-duty "O" ring neoprene gaskets held captive in the framed extrusion. All panels shall be detachable or hinged. Hinges shall be made of die cast aluminium with stainless steel pivots. Handles shall be made of hard nylon and be operational from both inside and outside of the unit. Units supplied with various sections shall be suitable for on-site assembly match drilled, with bolts, nuts and continuous neoprene rubber gaskets. All fixing and gaskets shall be concealed. Floor and roof panels shall be single skin type and shall be of same construction as the wall panels.

AHUs shall have hinged quick-opening insulated access door on fan and filter sections. Access doors shall be double skin type and shall be of same construction as the wall panels.

Four (4) lifting lugs shall be bolted to each base section for lifting or placing the AHU in place. All connecting fasteners and related hardware and its accessories shall be in stainless steel.

Sloping condensate drain pan shall be fabricated from 0.8mm (22g) stainless steel sheet and stainless-steel nipple for drain connection. It shall be isolated from bottom floor panel through 25mm thick heavy duty Treated for Fire (TF) quality expanded polystyrene or polyurethane foam. Drain pan shall extend beyond the coil.

Casing shall be of air-tight construction and sufficiently rigid to exclude vibrations, throughout the working capacity range of the AHU.

COOLING COILS

The coil section of the AHU shall be of the cartridge-type, removable from the side of the casing and supported over the entire length of the coil. Chilled water coil shall be plate fin type with aluminium ripple corrugated fins and staggered cleanable tubes with not more than 5 Fins per centimetre. Fins shall have collars, belled and firmly bonded to the tubes by having the tubes mechanically expanded into the fins.

Coil face velocity shall not exceed as specified on the coil schedule. The number of fins provided should be the minimum needed to meet the performance requirements to minimize the pressure drop across the coil. Coil casing shall be 1.5mm thick galvanized, steel with drain holes in the bottom channels to insure condensate drainage. Coil tubes shall be copper mechanically expanded into aluminium plate fins. No soldering or tinning shall be used in the bonding process. Coils shall be mounted in the unit casing on non-corrosive aluminium slide rails to allow for easy removal when required. Coils shall be designed to utilize the full available unit cross section area.

Coils shall be rated to ARI standard. Coils shall have automatic air vents, the vent outlets being piped to the drain pan with a copper pipe. Each coil shall be proof tested at 26 bar (375 psig) leak tested at 17 bar (250 psig) Coil performance shall be rated in accordance with ARI standard 410.

FAN

The fan section of the air handling unit shall be of rigid construction, with the fan scroll and bearings mounted on a frame rigidly secured to a formed channel base. Fans shall be of the double – width, double – inlet centrifugal type with FORWARD CURVED blades. Bearings shall be self-aligning, pillow-block type selected for an average life of 200,000 hours at design operating conditions and shall be provided with grease line extending to the outside of the AHU casing. Please see Equipment schedule for further details.

The fan wheels shall be keyed to the shaft and the complete wheel and shaft assembly shall be statically and dynamically balanced. Fan and shaft assembly shall be selected to operate at a speed of at least 25% below the first critical speed. Fan shall be designed for continuous operation at the maximum rated speed and capacity. Outlet velocity shall not exceed ASHRAE recommendations. Fan shall be driven by or internally unit-mounted motor connected to fan by V-belt drive. Access panel for easy belt change shall be provided for internally mounted motors. Belt connected motor capacity.

Motors shall be provided with adjustable bases for belt tensioning. The entire AHU fan -motor assembly shall be housed inside the AHU casing and mounted on an epoxy coated common steel base channel section with vibration isolation mounting. Fan should be provided with spring isolators.

Fan motor shall be of totally enclosed fan-cooled type and shall be suitable for 415V / 3 Ph / 50 Hz. Motor shall be sized to provide the additional power requirements when the fan is operated to provide an additional 20% of the rated capacity.

Supply fan performance shall be rated in accordance with ARI standard 430. Fans shall have AMCA certification, or it should have undergone testing in AMCA Certified Laboratory before getting dispatched to AHU Manufacturing Facility. The ratings which are to be submitted along with the proposal shall be based on the tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of AMCA certified ratings program.

DRAIN PAN

An insulated condensate drain pan shall be provided in each AHU which shall extend under the entire coil and fan section. The drain pan shall be of double-wall construction with 25 mm thick foam insulation cemented between the hot-dipped galvanised steel outer pan and inner pan. The inner pan shall be finished with a coating of water – proof and corrosion – resistant material. Drain connection shall be provided on both sides of the casing. The drain pan shall be sloped ¼ inch per ft and constructed to allow complete pan drainage.

Heavy duct flexible (Fire retardant) double layer canvas connection shall be provided at the outlet of AHU fan. Additional double layer canvas connection shall be provided between the GSS ducting and AHU. This canvas connection shall contain a provision (zip) for measuring the DBT and WBT of the cooled and dehumidified air.

The AHU shall be provided with the following accessories, bulkhead lamp, inspection windows, limit switch, extended grease lines and belt and motor guard.

FILTER SECTION

Pre-Filter:

Each unit shall be provided with a factory assembled filter section containing 48mm thick washable synthetic type air filters having GSS frame. The media shall be supported with High Density polyethylene (HDPE) mesh on one side and aluminium on the other side. Filter banks shall be easily accessible and designed for easy withdrawal and replacement of filter cells. Filter bank framework shall be fully sealed and constructed from GSS. The efficiency of the filters shall be 90% down to particle size of 10 microns as per IS 7613, and ASHRAE 52.1.

Filters - Codes and Standards.

- | | | |
|----|-----------------|--|
| a. | ASHRAE 52.1 | Gravimetric and Dust spot procedures for testing Air cleaning devices. |
| b. | IS 7613 | Methods of testing panel type Air filters for HVAC |
| c. | FED – STD – 209 | Clean room and workstation requirements. |

DAMPERS

Dampers shall be opposed blade type. Blades shall be made of double skin air foil extruded aluminium sections with integral gasket and assembled within a rigid extruded aluminium or nylon, turning in Teflon bushes. In case of automatic dampers, sealed ball bearings shall be provided, in place of Teflon bushes. Manual dampers shall be provided with a Bakelite knob for locking the damper blades in position. Linkages shall be extended for motorised operation if specified in data sheet A. Damper frames shall be sectionalised to minimise blade warping. Air leakage through dampers when in the closed position shall not exceed 1.5% of the maximum design air volume flow rate at the maximum design air total pressure.

AHU TOTAL (INTERNAL AND EXTERNAL) PRESSURE CALCULATION

Contractor shall submit calculations for the internal and external pressure of each AHU system based on the equipment to be selected and ducting system to be installed including pressure drops in coil, filter, ducts and fittings, VCD, FD, Diffusers etc. Contractor shall obtain approval from consultant on the SP Calculations before ordering AHU motor. Required motor HP based on actual Calculated SP shall be

provided without extra cost.

NOISE LEVEL

The noise level inside the AHU room should be less than 65dBA.

TECHNICAL REQUIREMENTS

Sl. no.	Description	Requirements
1	Quantity and Design capacity	40TR/16000Cfm- 3Nos. 14TR/5600Cfm-1No. 12TR/4800Cfm-1No. 10TR/4000Cfm-1No.
2	Cooled and Dehumidified air flow rate	As above
3	Cooling coil face area	Air velocity across cooling coil face area to be less than 2.5 m/s (500 FPM)
4	Number of rows for cooling coil	6 or 8 as per selection
5	Entering chilled water temperature - deg C	7 Deg
6	Leaving chilled water temperature - deg C	12 Deg
7	Drain connection on both sides of AHU	25/32 mm dia socket connection
8	No. of Fins	Not more than 13 FPI
9	Type of fan motor	415 V, 3 PH, 50 Hz TEFC Sq. Cage energy Efficient
10	Type of starter	Star-Delta / DOL
11	Pre-Filters (cleanable type)	Pre filters (panel type) of 90% efficiency down to 10 microns Class EU3 as per BS EN 779. Maximum face velocity 1.75 m/s

DATA TO BE FURNISHED BY TENDERER

Sl.	DESCRIPTION	REQUIREMENT
No.		
1	Air Handling Unit No.	
2	Type	Floor Horizontal, Top discharge
3	Model/ Make	
4	Air entering coil temperature (TE-DB deg C)	
5	Air entering coil temperature (TE - WB deg C)	
6	Air leaving coil temperature (TL - DB deg C)	
7	Air leaving coil temperature (TL - WB deg C)	
8	Maximum Air Face Velocity (m/sec) across coil	2.5
9	Maximum Air side pressure drop across coil in inches	
10	Total Fan Static Pressure in mm	
11	External Static Pressure in mm	
12	Chilled Water Entering Coil Temperature (deg C)	
13	Chilled Water Leaving Coil Temperature (deg C)	
14	Chilled Water Velocity - Maximum (m/sec)	
15	Coil Rows	
16	Coil Fins / Cm.	
17	Chilled Water Flow Rate GPM	
18	Maximum Chilled Water Pressure Drop (Feet) through	

	coil	
19	Type of Fan	FC / BC / Aerofoil
20	Type of Fan Control	Variable Air Volume / Constant Air Volume.
21	Maximum fan rpm	
22	Maximum outlet velocity	M / sec
23	Type of Filter (prefilter)	
24	Maximum Air side pressure drop across filter (Pascals)	
25	Type of Starter	
26	Motor Voltage	
27	Type of Vibration isolator	
28	Supply and return air noise treatment	
29	Controls	
30	Dimensions L x B x H	
31	Operating weight kg	
32	AHU motor kW rating	BKW / KW

DATA TO BE FURNISHED BY THE CONTRACTOR AFTER THE AWARD OF CONTRACT AND BEFORE INSTALLATION

1. Schedule of drawings and documents to be submitted for review, approval and information with submission dates.
2. Quality Assurance Plan (QAP).

3. Detailed P & I diagram showing clearly the scope of supply of equipment, piping with line sizes and material specifications, valves, specialities, instrumentation and control and all accessories. This drawing or documents mentioned under following clauses shall include all design data and information furnished in data sheets A and B. The makes of all major components and controls shall be indicated.
4. Dimensioned general arrangement drawing showing all equipment with accessories, mounting details, nozzle locations, etc.
5. Overall space and head room requirement with details of handling during erection, operation and maintenance.
6. Foundation drawing with static and dynamic loading data, pocket details, foundation outline, etc, for all items.
7. Cross-sectional drawings of all items with part list and materials of construction.
8. Performance curves and selection charts for fan, filters, etc. Selection charts and calculation for cooling coil and heating coil.
9. Operation and maintenance manual with lubrication schedule.
10. Catalogues furnishing detailed technical data for fan, coils, filters, etc.
11. CHECKLIST AND PERFORMANCE TEST DATA TO BE PROVIDED AFTER INSTALLATION:

Data Sheet:

Sl. No.	Description	Unit	Remarks
1.	Entering Air temp DB (deg C)		
2.	Entering Air temp WB (deg C)		
3.	Leaving Air temp DB (deg C)		
4.	Leaving Air temp WB (deg C)		
5.	Entering Water temp (deg C)		
6.	Leaving Water temp (deg C)		
7.	Coil / Filter area (SFT)		
8.	Face Velocity (FPM)		
9.	Air Flow (CFM)		
10.	Fan Speed (RPM)		
11.	Voltage		
12.	Current (A) = R- Phase		
	= Y- Phase		
	= B- Phase		
13.	Over load relay range A		
14.	Over load relay setting A		

15.	Inlet Water pressure (Kg / cm ²)		
16.	Outlet water pressure (Kg / cm ²)		
17.	Noise level AHU room (dBA)		
18.	Vibration level (Microns) = X - axis		
	= Y - axis		
	= Z - axis		
19.	Fresh air velocity (FPM)		
20.	Fresh air filter area (SFT)		
21.	Fresh air flow (CFM)		
22.	Designed CFM		

INSPECTION:

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

Air handling unit :

Air handling unit of cabinet type along with flexible connection at fan outlet, flexible connection at chilled water pipe inlet and outlet of AHU, filter, fan, motor, outlet damper etc., as specified in tender document shall form one unit for the purpose of measurement and payment.

Supply air fan unit :

Supply air fan unit consisting of fan, fan motor, louvers, filters, vibration isolators, sound attenuators, outlet dampers, flexible connection at fan outlet, weather proof enclosure of GSS cabinet type construction and accessories will be regarded as one unit for the purpose of measurement and payment. This is applicable for measurement and payment of Fresh air supply units, kitchen supply air unit and lift lobby supply air units.

Pre-filters:

Pre-filters and fine filters complete with support, frame etc., shall be measured from the approved drawings I as built drawing on the basis of core area (excluding margin flanges) and paid per unit area. Pre filters and final filters in supply air fan units are part of fan units and no separate payment will be made for the same.

CHILLED WATER PIPING & VALVES

SCOPE

This section lays down the general requirements for Supply, Installation and testing of all Piping works like Chilled Water, Condensate drain piping and Refrigerant piping and related valves and accessories.

CODES AND STANDARDS

The material construction, manufacture, inspection, testing and commissioning of water piping shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in this specification shall construe to relieve the CONTRACTOR of his responsibility. The equipment supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

SCOPE OF SUPPLY AND ERECTION

The CONTRACTOR shall supply all piping material like pipes, fittings, flanges and other items as required.

Scope of erection to be performed by the CONTRACTOR is outlined below:

- 1) The CONTRACTOR shall unload from carriers at plant site, handle, check, receive, transport, store, erect and test all materials furnished by him and others in accordance with this specification and General Conditions of Contract. The EMPLOYER shall be informed of any loss or damage within seven days of receipt of material.
- 2) The CONTRACTOR shall also install small accessory piping and any specialties furnished for equipment such as relief valves, built-in bypass and other equipment of this type.
- 3) The CONTRACTOR shall install primary elements for flow measurements, control valves and on-line metering equipment.
- 4) The CONTRACTOR shall hydrostatically test the entire piping system including valves and specialties.
- 5) All piping shall be internally cleaned and flushed by the CONTRACTOR before and after erection in a manner suited to the service as directed by the EMPLOYER.
- 6) For hydrostatic testing and water flushing, the CONTRACTOR shall furnish necessary pumps, equipment and instruments, piping etc. The EMPLOYER will provide water at available points of supply to which the CONTRACTOR's temporary piping will be connected.
- 7) The CONTRACTOR's scope under this includes the following:
 - a. Welding materials like welding electrodes, gas rods, oxygen, acetylene, propane and other consumable materials and backing rings etc., as required.
 - b. Jointing material as required for all screwed joints. Fasteners (bolts, nuts, studs washers etc.) and gaskets are required for all flanged joints.
 - c. Services of erection superintendents, erection superiors, fitters, riggers, other skilled and unskilled labour.
 - d. Erection tools, tackles and materials including welding machines.

MATERIAL SPECIFICATION

The material specification for piping, valves & specialties shall be as explained in later sections.

Colour code shall be used to identify pipe material. The CONTRACTOR shall be able to identify on request all random piping

prior to any field fabrication.

The CONTRACTOR shall furnish six (3) copies of certificates for piping for –

- a) Dimensions and
- b) Hydrostatic test

CLEANING OF PIPING

All piping shall be wire brushed and purged with air blast to remove all dirt and mill scale from inner surface. The method of cleaning shall be such that no material is left on the inner or outer surfaces, which will affect the serviceability of the pipe.

PROTECTION DURING TRANSIT

Effective precautions such as capping and sealing shall be taken to protect all pipe ends against ingress of dirt and damage during transit or storage.

SHOP AND FIELD HYDROSTATIC TESTS

All pipes and fittings shall be tested hydrostatically at the shops where manufactured to test pressures which are given in the applicable codes mentioned. All piping systems shall be tested hydrostatically by the CONTRACTOR after erection.

The chilled water and condensate drain piping shall be suitably insulated as per specification.

Automatic air vents shall be installed at all high sections of piping as well as in the AHU room piping. The discharge from these air vents shall be piped via copper tubes of appropriate size to the nearest waste drainpipe.

GUARANTEE

The CONTRACTOR shall guarantee all material, fabrication and workmanship, erection, installation and proper functioning of all the piping and also tightness of all joints, for a period of **one year** from the date of commissioning.

The CONTRACTOR shall employ both in shop and field, qualified personnel and welders qualified recently to the satisfaction of the EMPLOYER.

If any shop fabrication part fails to meet the field tests in such a manner that the EMPLOYER's Inspection believes that the defect is minor, it will be remedied in the field by the CONTRACTOR at no cost to the EMPLOYER. In the event the EMPLOYER rejects defective part as not being capable of remedy in the field, the CONTRACTOR may at the EMPLOYER's discretion be required to transport new parts, from his shop at his own expense.

WATER PIPING

All chilled water Piping shall be made out of High quality **UPVC** Pipe sections which are exclusively used for chilled water system in HVAC Application.

The chilled water Pipes shall be insulated with 50mm thick PUF Sections on which 26g Aluminium Cladding should be done.

The contractor shall ensure that The First fill of water shall be softened water.

PRESSURE GAUGES & THERMOMETERS

Bourdon type pressure gauges with aluminium casing with a minimum 100 mm dial and appropriate range complete with needle valves shall be provided at the inlet and outlets of heat exchangers, and pump sets.

Thermometers shall be of dial type mounted on a board with separable copper well. The case shall be of cast aluminium, weather & water proof type. Thermo well shall be provided at the inlet and outlet of all heat exchangers.

TESTING

- a. All piping shall be tested to hydrostatic test pressure of atleast $1\frac{1}{2}$ times the maximum operating pressure but not less than 7 KSC for a period of not less than 24 hours. All leaks and defects in joints and piping during the test shall be rectified and got approved. No pipe shall be welded with water inside the pipes. Piping repaired subsequent to the above pressure shall be retested in the same manner. Systems may be tested in sections and such sections shall be capped securely. Entire system shall then be retested. Noiseless circulation of water in the circuit should be achieved. If improper circulation due to air lock is found, it is the responsibility of the air -conditioning contractor to carry out all the rectification including opening and refinishing of floor, wall etc., Pressure gauges should be valved off during pressure testing. The air -conditioning contractor shall provide all materials, tools and instruments, services and labour required to perform the test and to remove the water resulting from cleaning and after testing.
- b. The consultants shall be informed well in advance by the air -conditioning contractor of his intention to test a section or sections of piping and all such tests shall be witnessed by the consultants or their authorized representatives. Test certificates duly signed by the contractor and the consultant shall be submitted by the contractor after completing the tests.
- c. No insulation shall be applied to pipes unless the pressure testing is completed to the satisfaction of the consultants/client. Insulation shall be done as per the tender specifications.
- d. After completion of the installation, the pipe lines are to be flushed thoroughly to blow out the

entire dirt and muck. Commissioning strainers shall be used before all equipment.

- e. The system then shall be balanced to deliver the water quantities as specified. Balancing report after certification shall be submitted with completion drawings and documents.
- f. Provide automatic air vents at highest points. The body shall be of cast iron and the float and leverage shall be of stainless steel. The operating pressure shall be 150 psig . Air vents, purge and drain valves are considered to be a part of the piping and no extra cost will be paid for the same. Provide expansion joints to prevent bending, bowing of pipes resulting in unusual stresses. The expansion joint shall be complete with anchor bases, inner liners, tie rods, outer jackets and flanges. The expansion joints shall be of stainless steel.
- g. Provide flanged rubber bellows at pump, chiller inlets and outlets that are assumed to be a part of the equipment.

VALVES

a) GATE AND GLOBE VALVES

Gate and globe valves up to 50 mm size shall be gun metal construction. Valves above 50 mm dia shall have cast iron body and bronze/gun metal spindle valve seat. The valves shall have non rising spindle.

b) BUTTERFLY VALVES

The butterfly valve shall be supplied along with flow control lever. The valves shall be compact in size and shall conform to BS 5155, MSS SP 67 and API 609. The valves shall be light in weight and easy to install. The body shall of close grain cast iron conforming to IS:210 and the seating shall be of Resilient black, Nitrile rubber / EPDM moulded on to the body. The disk shall be of SG iron nylon coated, whereas the shaft shall be of stainless steel A ISI 431 treated permanently for lubrication. The shaft seals shall be of Nitrile 'O' rings and rubber seals. Valves shall be suitable for a working pressure of 150 psig. Care should be taken during installation to see that the disk is not damaged during installation due to the flanges being incorrectly spaced. Provide gear operated valves for sizes having 150 mm and above. For smaller sizes such as 40 mm and below diaphragm type valves are acceptable.

c) BALL VALVES

Ball Valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends.

d) CHECK VALVES

Check valves for smaller sizes shall be of swing type of gun metal construction. Lift type check valves shall be used for horizontal lines. Wafer type plate check valves shall be used for bigger sizes as shown in the

specifications. The check valves shall be suitable for 10.5 KSC test pressure.

e) STRAINERS

Strainers shall be preferably of approved 'Y' type or pot type as specified in the tender schedule with GI or fabricated steel bodies. Strainers up to 50 mm shall be of gun metal type. Strainers shall have a removable bronze screen with 3 mm perforations and permanent magnet. Strainers shall be provided with flanges. They shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of all screen without disconnection from the main pipe. Strainers shall be provided with isolating valves so that they may be cleaned without draining the entire system.

f) MANUAL CHILLED WATER FLOW BALANCING VALVES

Balancing valve shall be installed in branch pipe connecting cooling coils of AHU and wherever shown on drawing. These valves shall be factory calibrated. Each valve shall limit flow rates to within $\pm 5\%$ accuracy, regardless of system pressure fluctuations. Sufficient number of flanges and unions shall be provided as required to facilities maintenance work once the piping is installed. Piping shall be properly supported on or suspended from stands, clamps, roller hangers, etc. , as required. The contractor shall adequately design all brackets, saddles, clamps and hangers and shall be responsible for their structural integrity. Each support shall be isolated from the support by means of anti - vibration springs or durable liner of neoprene rubber. Pipe supports shall be of steel and shall be painted with rust preventive paint and finish coated with synthetic enamel paint of approved color . Only factory made supports with Galvanized fully threaded rods with bands are acceptable. The chilled water pipes shall be isolated from the bands by a rubber sheet. Pipe supports on the terrace exposed to weather shall be hot dip galvanized.

g) The spacing of pipe supports shall not be more than that as specified below:

NOMINAL PIPE SIZE IN M	SPACING IN M
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Upto 25 mm	1.5 m
------------	-------

32 to 150 mm	2.5 m
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above 150 mm	3.0 m
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The GI support rods shall be 8 mm thick for pipes upto 50 mm dia, 10 mm for pipes from 65 mm to 125 mm dia and 12 mm for pipes 150 mm dia and above.

i) Extra supports shall be provided at bends and heavy fittings like valves to avoid undue stresses on the pipes.

j) Suitably designed blocks shall be used for resting the pipe on the supports wherever required.

- k) Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars attached to pipe with a 12 mm thick rubber pad. Risers shall also have a suitable concrete pipe support at the lowest point.
- l) Pipe sleeves of 50 mm larger diameter than the pipe shall be provided wherever pipes pass through the walls and the annular space filled with felt and finished with retaining rings. Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation. 14 gauge sheet shall be provided between the insulation and clamps, saddle extending at least 10 mm on both sides of the clamps, saddles.
- m) All welded bends shall be of 5 piece construction for pipe sizes 200 mm dia and for larger pipes atleast 7 piece construction shall be provided.
- n) All piping work shall be carried out in a workman like manner causing minimum disturbance to the existing services. Piping installation shall be carried out with vibration elimination fittings wherever required. While installing the pipes, adequate clearance shall be provided for insulation wherever insulation is called for.
- o) Drains shall be provided at all low points in the piping system and shall be of the following sizes:

MAIN LINE SIZE IN MM	DRAIN SIZE IN MM
Up to 300	25
Over 300	40

Drain shall be provided with gate valves of equal size but with rising spindle. Alternatively, ball valves shall be provided. Drain shall be piped through G. I medium class pipe to the nearest floor drain. Piping shall be pitched towards the drain points. Wherever specified, drain pipes for the ceiling suspended units and fan coil units shall be provided with water grade blue HDPE/PVC pipe with screwed joints. The joints shall be proper so that no water leaks over the false ceiling. The pipes shall be tested for leaks to a minimum pressure of 1 KSC before the false ceiling sheets are fixed.

- p) Air vents shall be provided at all high points in the piping system for venting. Air vents shall be of

gun metal construction and of automatic type. Similarly drain valves shall be provided at all dirty legs. The size of the valves shall be 25 mm size for pipes up to 100 mm and 40 mm for sizes larger than 100 mm. Drain shall be closed with dummy caps to prevent accidental opening.

CHECKLIST AND PERFORMANCE TEST DATA TO BE PROVIDED AFTER INSTALLATION

Sl. No.	Description		
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		Unit	Remarks
1	Hydrostatic pressure conducted as per Specification		
2	Any leaks		
3	Any defects in joints		
4	Tested after rectifying defects		
5	Test witnessed and certified		
6	Any noise in piping system		
7	Any water noise in coils		
8.	Any water noise in equipment		
9.	Proper flow achieved through AHU, FCU		
10.	Piping insulation checked		
11	All valves open		
12	All motorized valves close / open		
13	Expansion joints provided and checked		
14	Pipe work cleaned		
15	Water condition after pipe cleaning		

	checked		
16	Expansion tank Ball valve functional		
17	All strainers clean		
18	Pressure gauges working		
19	Thermometers working		
20	Drain points provided at Low points		
21	Air vents provided at High points		
22	Pipe support and spacing checked		
23	Pipe material checked		

INSPECTION:

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

Piping and Pipe insulation

All water pipes and other pipes be measured nett length and measured linear over all fittings such as bends junction etc., and given in running metres. The length shall be taken along -With centre lines of the pipes and fittings. The unit rate shall include fittings (Elbows, Tees, bends, Mitres, Reducers, flanges, Gaskets, Bolts, Nuts, CAPS, Blind flanges and end closures). The measurements will be based on the approved drawing / as built drawing and paid per unit running metre. Length of other fittings (valves and strainers), which are paid under appropriate item, shall not be re-measured under linear measurement. The bill of

quantities specified does not include any wastages during fabrication and erection. These shall be included by the tenderer in the unit rate. Also the unit rate quoted shall include piping insulation for chilled water piping and other pipes, no separate payment will be made for piping insulation.

Valves

Each Valve including accessories shall be regarded as one unit. The quantity of valves will be based on the approved drawing /as built drawing for the purpose of measurement and payment. Also the unit rate quoted shall include valve insulation for valves in chilled water piping, no separate payment will be made for valve insulation. The unit rate quoted for motorized valves shall include cost of actuators, no separate payment will be made for valve actuators.

Strainers

Each strainer including accessories shall be regarded as one unit. The quantity of strainer will be based on the approved drawing I as built drawing for the purpose of measurement and payment. Also the unit rate quoted shall include strainer insulation for strainers in chilled water piping, no separate payment will be made for strainer insulation.

SHEET METAL WORK

SCOPE

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

Governing Standards

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

Raw Material

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

Galvanising shall be of 120 gms/ Sq.mt. (Total coating on both sides)

In addition, if deemed necessary, samples of raw material, selected at random by client's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense. G.I. raw material should be used in coil - form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross-section dimensions.

Duct Connectors and Accessories: All transverse duct connectors (flanges /cleats) and accessories / related

hardware are such as support system shall be zinc coated (galvanized).

FABRICATION STANDARDS

All duct work including straight sections, tapers, elbows, branches, shoe pieces, collars, terminal diffuse boxes and other transformation pieces must be factory – fabricated Coil line to ensure location of longitudinal seams at corners / folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any face side of the duct.

All ducts, transformation pieces and fittings to be made on CNC profile cutters for required accuracy of dimensions, location and dimensions of notches at the folding lines.

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

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

SELECTION OF G.I. GAUGE AND TRANSVERSE CONNECTORS

Duct Construction shall be in compliance with 1 “(250 Pa) w.g Static norms as per SMACNA. All transverse connectors shall be 4 bolt slip – on flange system with built-in sealant.

The specific class of transverse connector and duct gauge for a given duct dimension will be as per Table 1 below for 1” (250 Pa) pressure class.

Non – toxic, AC – applications grade P.E. or PVC Gaskets are required in between all mating flanged joints. Gasket sizes should conform to flange duct manufacturer’s specification.

DUCT CONSTRUCTION

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

Dimensional Tolerances: All fabricated dimensions will be within $\pm 1.0\text{mm}$ of specified dimension. To obtain required perpendicular, permissible diagonal tolerances shall be $\pm 1.0\text{ mm}$ per metre.

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

Ducts shall be straight and smooth on the inside. Longitudinal seams shall be Airtight and at corners only, which shall be either Pittsburgh or Snap Button Punch as SMACNA practice, to ensure air tightness.

Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitters shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence. Plenums shall be factory fabricated panel type and assembled at site. To be supplied along with Air Handling Units by AHU supplier only.

SUPPORT SYSTEM

A completely galvanized system consisting of fully threaded rods, double L bottom brackets (made out of 3.0 mm M.S. sheet) nuts, Washers and anchor bolts as supplied by Rolaster or approved equivalent or generally conforming to SMACNA standards should be used.

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

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

INSTALLATION

Tools and tackles for site work

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

- a) Electric Pittsburgh Seamer – used for closing Pittsburgh joints.
- b) Electric Slitting shear – to make cut – outs.
- c) Drilling machine with drill bits – for drilling holes in sheet metal work.
- d) Hammer drill machine with drill bits – for drilling holes in building structures for anchors.
- e) Hoisting system – for lifting the duct assembly upto mounting heights.

Installation Practice

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

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

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

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

the building.

Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick appropriate insulation around the duct and totally covered with fire barrio mortar for complete sealing.

All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, Air Handling Units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge.

DOCUMENTATION & MEASUREMENT OF DUCTING

All ducts fabricated and installed should be accompanied and supported by following documentation:

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

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

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

TESTING

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

DUCTWORK LEAKAGE TESTS

Type

All ductworks shall be pressure tested for leakage, smoke test is not acceptable.

The Sub-contractor shall provide the necessary test equipment and skilled labour to carry out the tests satisfactorily. Tests shall be witnessed and certified by the Consultant or his representative. Prior to witness of final tests, the sub-contractor shall carry out preliminary tests to ensure the test results are within specified limits.

All duct work shall be tested for leakage without duct insulation or duct enclosure at the joints. Accuracy of the test apparatus shall be within $\pm 5\%$ of the indicated flow rate or 0.4 l/s, whichever is greater, and 5% of the indicated static pressure in duct under test.

The test apparatus shall have a calibration certificate, chart or graph dated not earlier than one year before the test for which it is used.

DAMPERS

Fire Damper (FD)

The scope of the fire damper supply inclusive of Fire damper, Sleeves, Duct connecting GI Flanges, Wall retaining GI flanges, Actuator / Fusible links, Temperature sensor / smoke sensor, control panel, step down transformer, Fire sealant material, supports, bolts & nuts etc., The scope also inclusive of necessary installation, testing and commissioning of the same.

Fire damper control options

With Fusible Link and Spring Mechanism

The damper is held open by a replaceable fusible link rated at 74°C (U.L. stamped). In the event of the increase in temperature the fusible link shall melt & the damper shall close shut with spring action. actuates and releases the blades to shut off.

Aluminium Opposed Blade Collar Damper

The collar damper should be of robust construction for positive control of air at the supply air collar position, to be of multiple leaves oppose blade type made of high-quality extruded aluminium extruded alloy. It should be provided with necessary linkage for smooth operation. These dampers should be with anodized matt black finish for durability and non-visibility. It shall be installed at the terminal supply air collar / neck of the grille / neck of the diffuser. These dampers are to be provided with key for the operation from the face of the grille or diffuser at the same time it should not projected out of the grille / diffuser.

INSULATION

SCOPE

The supply and return air ductwork shall be provided with insulating materials complying to the technical data specified herein.

Insulation deviating from the specification shall only be offered as an alternative.

Full technical data and specification in respect of the insulation offered shall be submitted with the tender.

EXTERNAL INSULATION OF CONCEALED DUCTS

All supply air ductwork located in false ceiling and other concealed areas shall be externally wrapped with 13 mm thick Closed cell nitrile rubber elastomeric/XLPE insulation with Aluminium foil.

The thermal conductivity shall not exceed 0.034 W/mk (0.235 BTU in/ft²/h/°F).

The nitrile rubber elastomeric/XLPE insulation shall be classified as non-combustible by the Fire Authority and tested in accordance with BAS 476: Class O Standard.

The Aluminium foil shall have a flammability index of 2 and be tested in accordance with BS 476: Part 7: 1971, or Australian Standard 1530 Parts 2:3.

INTERNAL (ACOUSTIC) INSULATION DUCTS:

Acoustic insulation shall be provided for the following: All supply air plenums.

Insulation material shall be Open cell cross linked polyolefin foam insulation/XLPE insulation of density 30 kg/ m³ and fire retardant in nature. The thermal conductivity (K) value shall not be more than 0.041 W/m K . Thickness shall be minimum 12 mm for Duct Acoustic Insulation. Manufacturer recommended adhesive shall be used to ensure adherence of duct insulation to surface of the ducts.

CHILLED WATER PIPING FOR AHU AND FCU

All chilled water piping, condensate drain piping shall be insulated as indicated herein. Prior to application of insulation, all pipe work shall be cleaned on the surface with wire brush to remove dirt and dust.

The insulation for chilled water piping shall be carried out from 50 mm PUF insulation covered with 26 G Al. cladding having a minimum 'K' value of 0.032 W/m k at mean temperature of 200 C and a density of 25 Kg/cum.

Arrows indicating direction of flow shall be clearly marked.

SYSTEM STARTUP AND COMMISSIONING **Work Included**

This Section specifies the requirements for pre balance, start-up, and commissioning of mechanical systems, including, but not limited to:

General purpose and comfort air handling systems With Chilled water system.

Requirements for the following are included:

- i) HVAC systems pre balancing.
- ii) HVAC systems manual run.
- iii) HVAC systems balancing.
- iv) HVAC control system testing.
- v) HVAC systems, commissioning.
- vi) HVAC systems 72 hour acceptance test.

Related Work

This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish

the total standard requirements for HVAC systems start-up and commissioning:

Provide services described in this section and in accordance with Builder Start-up Program see the Systems Start-up and

Commissioning Appendix, at the end of this section. Contact Builder for a copy of this document

Quality Assurance

ASHRE Project Managers Guideline 1, the HVAC Commissioning Process. Definitions

HVAC systems commissioning consists of the following:

Verify operation and functional performance of HVAC systems for compliance with design documents. Document HVAC tests inspections.

Verify application of operation and maintenance manuals, as-built (record) documents, spare parts listing, special tools listing, another items as may be specified herein for support of HVAC systems and equipment.

Coordinate and direct training to personnel for operation and maintenance of HVAC equipment and systems. Documentation

The Subcontractor shall prepare and have ready the following documents at the start of commissioning: Project plans and specifications (Subcontract documents), authorized revisions, HVAC shop drawings and submittals (approved), test and balance reports, equipment start-up and certification reports, etc.

Records of required code authority inspections documentation signoff, etc.

Submittals

Submit the following for approval prior to starting the commissioning process:

i) Commissioning plan scheduling, sequence, documentation requirements, verification procedures, staffing requirements, etc).

ii) Training plan (scheduling, sequence of training personnel involved, etc.).

iii) Tool list.

After commissioning is complete, the Subcontractor shall submit all documentation obtained Products Instrumentation

The Subcontractor or agency performing prior tests shall provide instrumentation. Individual subcontractor shall operate instruments or agency as requested by Subcontractor.

Execution

General

Subcontractor personnel involved in commissioning (commissioning team) shall actively participate in construction phase of the project to ensure compliance with HVAC commissioning requirements.

Procedure

Commissioning team shall attend preconstruction meeting and establish requirements for HVAC commissioning authority process throughout construction phase.

Commissioning team shall prepare and submit to Contractor and Builder an HVAC commissioning outline which shall include: Responsibility of each trade affected by HVAC commissioning, as required by appropriate paragraph of this Section.

Requirement for documentation of commissioning process.

Requirements for documentation of HVAC tests and inspections required by code authorities. Format for training program for operation and maintenance personnel.

Commissioning team shall periodically attend construction and coordination meetings.

HVAC Systems Pre-balance

Subcontractor shall perform the following work for pre-balancing of all air hydraulic systems:

Prior to completion of the duct and piping systems, the mechanical subcontractor shall coordinate and fully cooperate with the balancing subcontractor. All drawings shall be checked and any dampers, balancing valves, or devices not shown on the Drawings, but necessary for proper balance as determined by the balancing subcontractor, shall be added or relocated at no additional cost. After completion of the duct and piping systems, the mechanical and balancing subcontractors shall both certify, in writing, to Contractor that the systems have been checked and that all devices are installed to facilitate the balancing work.

Complete all duct and piping pressure testing as specified.

Complete all punch list items which may affect balancing.

Remove all shipping and storage protection; remove shipping locks from vibration isolators and clean debris from under all isolated equipment.

Check all motors for rotation. Log RPM, voltage, and amps.

Check starter heater sizes for conformance with motor nameplate data.

Adjust and align all sheaves and belts; set all adjustable sheaves to provide specified RPM. Ensure all rotating components turn freely without interference or binding.

Install temporary construction filters or media as required. et all dampers, diffusers, grilles, extractors, inlet vanes, valves, and balance valves to the full open position.

The controls subcontractor shall, either via the control system or manually at each device, fully open all automatic control valve and dampers.

Drill all probe holes required for static pressure readings, pitot tube traverse readings, and temperature readings. Coordinate locations with balancing subcontractor. Install plastic plugs in all such holes.

Clean interior of all plenums, casings, and ducts, and install all specified filters.

Lubricate all equipment per manufacturer's recommendations and provide access to lubrication fittings as

required.

Align all pumps and ensure that bases are grouted as required; check alignment of all flexible pump connectors. Flush clean all piping systems from debris. Treat piping systems with chemicals, if required.

Fill, bleed, and charge with chemicals all piping systems.

HVAC Systems Manual Run

Upon the completion of above and the submission of the documentation required for above Items, the Subcontractor shall perform the following:

- a. Charge and start chillers, pumps, ceiling suspended units and all other major pieces of equipment. Manufacturer's representatives shall perform the start-up of all major equipment. Setting of all operating and limit equipment controls shall also be by manufacturer's representative. Log all settings and furnish a start-up report for each piece of equipment.
- b. Check all systems and equipment for excessive noise and vibration. Check and adjust all spring isolators and replace any that are "bottomed out". Any problem area shall be reported to Contractor and Builder for corrective action.
- c. Perform final vibration balance and testing for equipment requiring vibration balancing after installation as specified.
- d. Operate all equipment manually (in the LOCAL or HAND mode) for a minimum of 5 (five) consecutive 8 hour days. All variable frequency drives shall be set to HAND or MANUAL (not BYPASS) with the output set at 100 percent. Repair or replace any piece of equipment, which fails during this period, and restart the test for that machine.
- e. After such time as all systems have been successfully operated for the aforementioned 5-day period, the mechanical subcontractor shall so notify Contractor so that the balancing subcontractor may begin his work.
- f. At the completion of the above test run, remove all start-up strainers. Clean all permanent strainers. Replace temporary filters and/or clean permanent filters. Generally, make all systems ready for full-time operation.

HVAC Systems Balancing

- a) Air and water balancing have been specified under separate paragraphs of this Section. The Subcontractor shall provide the following support during balancing:
- b) Make available a qualified technician for 10-man hours to assist and instruct the balancing subcontractor. The Subcontractor shall document (via daily time vouchers signed by Contractor) any labour thus

expended. At the completion of the project the Subcontractor shall credit to Contractor any unused labour at standard hourly rates per the Bid Form.

c) The mechanical subcontractor shall operate and maintain all equipment and systems for the use of the balancing and controls sub-contractors from the time of initial start up until the successful completion of the final 72 hour test, Builder acceptance, and start of the warranty period.

It shall be the responsibility of the balancing subcontractor to determine and convey to the mechanical subcontractor the sizes of any required fan sheave changes. Any sheave replacements shall be the responsibility of the balancing subcontractor and will be treated as a change order for this project.

HVAC Control System Testing

a) The control system testing phase requires that the controls subcontractor, with assistance from the mechanical subcontractor as necessary, perform a complete checkout and verification of the proper operation and calibration of all system points, sequences, interlocks with associated systems (e.g., fire alarm and equipment switchover for backup), and loop functions. The purpose of this phase of work is to place the system into automatic operation in preparation for verification of the mechanical and controls system operation by the 72-hour system acceptance test.

b) The testing phase will consist of the following steps:

1) Field testing and verification (loop checks).

2) Performance verification.

3) Test 1 is conducted by the subcontractor. This portion of the test verifies accurate wiring and pneumatic connections from control devices, i.e., sensors, valves, thermostats, damper actuators, switches, relays, and control panels.

4) All sequences of operation specified and identified in the Drawings and specifications shall be tested. Calibration of sensors, transmitters, controllers, and actuators to achieve set point tolerances for all control loops shall be accomplished during this test.

d) The controls subcontractor shall submit checklist forms to Contractor for approval at least 2 weeks prior to beginning Test 1. These forms shall identify all devices, sequences, set points, etc., which are to be tested as part of Test 1.

f) Project Managers and Builder may choose to observe any or all of the testing performed for Test 1.

g) Test 2 is the demonstration by the controls subcontractor to Contractor and Builder that all equipment is tested and ready for final system commissioning.

a) Test 2 will be started after three prerequisites are met: Test 1 must be completed by the Subcontractor.

- b) The completed Test 1 checklists have been submitted to and approved by Project Managers and Builder.
- c) The controls subcontractor shall certify in writing that each wiring and pneumatic connection has been checked, the operation and calibration of each device has been verified, all sequences have been observed, and all have been found to be complete and operational.

HVAC Systems Commissioning

- a. HVAC systems commissioning shall begin after the pre balance, manual run, air and water balancing, and control system testing phases are completed.
- b. Builder and Project Managers shall be included in the commissioning process.
- c. Verify air and water balancing readings, such as supply and return air quantities, fan performance, hydraulic performances, branch duct readings, boiler performance, chiller performance, cooling tower performance, etc.
- d. Verify calibration of temperature sensors, relative humidity sensors, dew point sensors, pressure transmitters, and related controls, such as damper settings, valve positions, VAV boxes, etc.
- e. Verify readings of remote data and control systems, such as temperature, relative humidity, dew point, pressure, damper positions, variable frequency drive settings, etc.
- f. Verify operation of system modes, such as humidification / dehumidification, smoke purge system operation, equipment failure and backup unit startup, etc.
- g. Verify that total HVAC systems are performing to provide conditions outlined in design documents such as temperature control, humidity control, pressurization control, control system response, etc.

Mechanical and Electrical 72 Hour Systems Acceptance Test

- a) The purpose of the 72 hour systems test is to demonstrate that the overall system will function reliably and in accordance with the design documents.
- b) Systems that are capable of producing trend logs for control points shall be utilized to produce these logs to record the status of temperature, pressure, humidity, etc., during the test. The points to be monitored will be determined by Contractor and Builder.
- c) The 72 hour test is a prerequisite to obtaining a notice of Substantial Completion for the mechanical, electrical, and control systems. Equipment and systems warranties shall begin with Substantial Completion and acceptance by Builder.
- d) Successful completion of the 72 hour test is a prerequisite to obtaining a notice of Substantial Completion for the mechanical, electrical, and control systems. Equipment and systems warranties shall begin with Substantial Completion and acceptance by Builder.
- e) e) All HVAC systems and associated control and alarm interlocks shall be operated for a period of

72 consecutive hours. During the 72 hour period, all systems shall function in a completely automatic mode without any equipment shutdown or malfunction. All systems shall operate to maintain design sequences and conditions.

- f) Any system shutdown, malfunction, or deviation from design sequences during the 72 hour test will be cause to discontinue the test and restart after faults are corrected. Builder will determine if a failure is severe enough to discontinue the test.

LIST OF APPROVED MAKES

DESCRIPTION	MAKE
CHILLER	BLUE STAR / VOLTAS / CLIVET/CLIMAVENETA / TRANE/CARRIER
PUMPS	GRUNDFOS/WILO/KSB/SHAKTI PUMPS/ARMSTRONG
AHU	ZECO/AIR BLOW / CARYAIRE / VAYHAN / EDGETECH/VTS
FLEXIBLE COUPLING	CORI / KINFLEX
MOTORISED BUTTERFLY VALVE	ADVANCE / DANFOSS/HONEYWELL/DANFOSS
BUTTER FLY VALVE	DANFOSS/ADVANCE/ZOLOTO/AMTECH/AUDCO
BALANCING VALVE	DANFOSS/ADVANCE/AIRA/ZOLOTO/ AUDCO
Y STRAINER	ADVANCE / SANT / DANFOSS
3 WAY MODULATING VALVE WITH THERMOSTAT	HONEYWELL / JHONSON / DANFOSS/SIEMENS
TEMPERATURE & PRESSURE GAUGE	WAREE / WIKA/H GURU/RADIX
UPVC PIPE	ASTRAL/ASHIRWAD/PRINCE/SUPREME/PRIME
CPVC PIPE	SUPREME/ASTRAL/ASHIRWAD/PRINCE/PRIME
GI SHEET	TATA / JINDAL
GI FACTORY FABRICATED DUCTING	ROLASTAR/DEV DUCT/ CAM DUCT
ALUMIUM GRILLS	JAYDEE / AIRMASTER / AIRGUIDE
COLLAR DAMPER	JAYDEE / AIRMASTER / AIRGUIDE

WALL ACOUSTIC INSULATION	UP TWIGA/ OWENSCORNING
THERMAL & ACOUSTIC INSULATION	SUPREME / K-FLEX / VIDOFLEX/SUPERLON
HVAC ELECTRICAL DISTRIBUTION PANEL	LOTUS/THITANIX/BLUE VOLT/DANFOSS
MOTOR PROTECTION CIRCUIT BREAKERS	L&T/ABB/SIEMENS
STAR DELTA STARTER PANEL	L&T/ABB/SIEMENS

Sl.No.	ITEM DESCRIPTION	MAKE
1	Air circuit breaker	Schneider / L&T / ABB / GE
2	MCCB	Schneider / L&T / ABB / GE
3	Relays	AVK-SEGC / ABB / Telemecanique / L&T / Schneider
4	Power factor relay	Epcos / Ducati / Beluk / Enercon / Meher
5	Change over switch	HPL / Schneider / L&T / ABB
6	Power contactors	L&T / ABB / SCHNEIDER / TELEMCHANIQUE
7	Instrument transformers	Kappa / Kalpa / Instrans / Voltamp
8	Capacitor banks with series reactors with harmonic filters	Epcos / Ducati / Meher
9	LT panel fabrication including Bus duct	Power Control Equipments / Lotus Power gear / CPRI Approved
10	Meters	Conserv, L&T, AE. Elmeasure
11	Panel accessories / terminal block	As per manufacturer specified make
12	MCB / MCB DB	Legrand / Schneider / Havells / L&T / ABB
13	ELCB / ELMCB / RCBO	Legrand / Schneider / Havells / L&T / ABB
14	LT Cable	Finolex/ Poly Cab / Havells / KEI
15	End Termination Materials	Dowels / SMI / Wago
16	MS Powder coated Cable Tray	As per panel fabricator
17	PVC Conduits - FRLS	VIP / Avon / Precision / Universal
18	PVC Wires & Flexible Cables - FRLS	Anchor / Power Flex / Finolex / L&T / Havells
19	Modular switches and socket	Anchor Woods / MK / Legrand / L&T Oris
20	Industrial sockets	Legrand / L&T / ABB
21	Light fixtures - working area	Philips / Wipro / Thorn / GE
22	Light fixtures - decorative	Philips / Wipro / Thorn / GE
23	Street light pole	Klite / Shubham / Jindal

24	Glands - Single / Double Compression	Dowells
25	Aluminium / Copper Lugs	Dowells
26	Aviation Light	Bajaj / eq.
27	Surge Arrestors	L&T / ABB / OBO Betterman

