INDIAN INSTITUTE OF SCIENCE EDUCATION & RESEARCH

(Established by Ministry of Human Resource Development, Govt. of India)
IISER Mohali, Sector-81, Knowledge City, SAS Nagar-140306

Tender Documents

Name of Work: Setting up of research labs of Dr Indranil Banerjee & Dr S Rakshit with provision of class 10000 air quality at IISER Mohali.

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IISER Mohali, Sector-81, Knowledge City, SAS Nagar-1403061

Tender Form Cost- Rs. 500/-

Tender Ref. No.: IISER/EE-EO/Estimate-P/17-18/08 **Date:** 04.11.2017

Notice Inviting Tender

1. The Executive Engineer on behalf of the Director, IISER Mohali, invites online bids under two bid system i.e. technical bid and financial bid through E- Central Public Procurement Portal i.e. https://eprocure.gov.in/eprocure/app from eligible contractor for the work mentioned below.

Name of work:- Setting up of research labs of Dr Indranil Banerjee & Dr S Rakshit with provision of class 10000 air quality at IISER Mohali.

Tender Ref No	:	IISER/EE-EO/Estimate-P/17-18/08
Estimated cost	:	INR 39,60,799/-/-
Earnest Money	:	INR 80,000.00/-
Stipulated period of work	:	Three (03) months

Critical Date Section

S. No	Particular	Date	Time
1.	Tender publishing date and time	04.11.2017	03:00PM
2.	Tender documents download start date and time	04.11.2017	03:00PM
3.	Bid submission start date and time	04.11.2017	03:00PM
4.	Bid submission end date and time	14.11.2017	03:00PM
5.	Technical bid opening date and time	15.11.2017	03:30PM

2. Tender document may be downloaded from the website of E-Central Public Procurement portal (https://eprocure.gov.in/eprocure/app) and www.iisermohali.ac.in . Tender should be submitted online along with valid documents of eligibility criteria wsithin the date mentioned above.

3. The Director, IISER Mohali shall be the “Accepting Authority” hereinafter referred to as such for the purpose of this contract.

4. For any information, other modifications and/or corrigendum may kindly visit IISER Mohali website http://www.iisermohali.ac.in and also publish on https://eprocure.gov.in/eprocure/app.

SUBMISSION OF TENDER:

Tender shall be submitted by the Bidders in two parts:

(i) Technical Bid. – Cover I (ii) Financial Bid. - Cover II

The two bid system will be followed for this tender. In this system the bidder must submit bid **on line at E-Procurement Portal(i.e. https://eprocure.gov.in/eprocure/app)** his offer in two covers. "**Cover No. l- Technical Bid along with requisite fee details and all forms under seal and signature of Bidder" mentioned below and "Cover No.2 - Financial Bid"** respectively.

The **Cove I** (Technical Bid) shall consist of following:

i) **Earnest Money** -The bidder shall furnish as part of its bid, an EMD of Rs. 80,000.00/- (Rupees eighty thousand only). The EMD is to be submitted through Demand Draft of any Scheduled / Nationalized Bank (drawn in favour of "Registrar, IISER, Mohali").

ii) Cost of Tender Form - The Cost of Tender Form Rs.500 is to be submitted through Demand Draft of any Scheduled *1* Nationalized Bank (drawn in favour of "Registrar, IISER, Mohali").

Note - The original payment instrument like Demand Draft of any Nationalized Bank against Earnest Money and Cost of Tender Form sent to the address- **IISER Mohall, Sector-81, knowledge City, PO- Manauli, SAS Nagar Mohal1140306, Punjab** by post/speed post/courier/by hand before bid opening date & time

iii) **Important Documents uploads in .pdf format only:-**

a) Scanned copy of DD of EMD and Cost of Tender Form.
b) Scanned copy of PAN Card.
c) Scanned copy of IT Return for the last three financial years.
d) Scanned copy of work experience in Govt. Department
e) Scanned copy of partnership deed
f) Scanned copy of Power of Attorney
g) Scanned copy of Tender Accept Letter

The Cover II (Financial Bid) shall consist of following:

* Schedule of price bid of in the form of BoQ_XXXXX.xls (Will be formulated according to the type of work)

-sd-
Executive Engineer
Head IWD, IISER Mohali

NOTICE INVITING TENDER

1. Online item rate tenders are invited on behalf of the Director IISER Mohali from approved and eligible contractors for the work of " Setting up of research labs of Dr Indranil Banerjee & Dr S Rakshit with provision of class 10000 air qualityat IISER Mohali."

The enlistment of the contractors should be valid on the last date of tenders.

In case only the last date of sale of tender is extended, the enlistment of contractor should be valid on the original date of sale of tenders.

In case both the last date of receipt of application and sale of tenders are extended, the enlistment of contractor should be valid on either of the two dates i.e. original date of sale of tender or on the extended date of sale of tenders.

1.1 The work is estimated to cost Rs. 39,60,799 /-. This estimate, however, is given merely as a rough guide

1.1.1. The authority competent to approve NIT for the combined cost and belonging to the major discipline will consolidate NITs for calling the tenders. He will also nominate Division which will deal with all matters relating to the invitation of tenders.

For composite tender, besides indicating the combined estimated cost put to tender, should clearly indicates the estimated cost of each component separately. The eligibility of tenderer will correspond to the combined estimated cost of different components put to tender.

NB:- The contractor, whomsoever the work is awarded, shall be require to submit the proof checked structural drawing from the structural consultant.

1.2 CRITERIA OF ELIGIBILITY

1.2.1 Bidder shall submit the tender fee of Rs. 500/- and EMD of RS 80,000/- favoring Registrar, IISER Mohali and payable at Chandigarh.

NB- Original DD sends at Executive Engineer, IISER Mohali, Sector 81, Knowledge City, SAS Nagar, Mohali.

1.2.2

The tender shall be received by the undersigned by on 14.11.2017 up to 3:00 pm and envelope No. 1 only containing earnest money, conditions and tender documents shall be opened on the next working day in the presence of tenderer or their authorized representative who may like to be present. No consideration will be given to a tender received after the above stipulated time and date. Eligibility related documents shall be evaluated for criteria stipulated at 1.2.3 and agencies/contractors will accordingly be qualified/disqualified by the competent Authority. The financial bid (Envelope No 2) of qualified tenderer shall then be opened at notified time, date and place in presence of tenderer or their representative. The rates of each item must be quoted in figures

1.2.3 Contractors who fulfill the following criteria shall be considered by IISER Mohali for technical evaluation (if required) and opening of commercial bids:

I) Contractors /firms should have successfully completed during last 7 years ending last day of the month previous to the one in which the bidding are invited, either three similar works costing not less than 40% i.e. Rs.15.85 lacs or two similar works costing not less than 50% i.e. Rs.19.81 lacs and one similar work costing not less than 80% i.e. Rs.31.69 lacs of the estimated cost of the work.

II) Average annual financial turn over during the last 3 (three) years ending 31st March of the previous year should at least be 100% of the estimated cost of work.

III) Not incurred loss in more than two years during the last five years ending 31st March of the previous year.

1.2.4 Eligibility criteria:

I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for tendering in the Institute in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

For the purpose of clause 'Similar work means HVAC work comprising VRV, AHU, condensation/ drain pipe, control cable, etc'

2. Agreement shall be drawn with the successful tenderer on General Conditions of Contract for works which is available from the Engineer-in-Charge. Tenderer shall quote their rates as per various terms and conditions of the said form which will form part of the agreement.
3. The time allowed for carrying out the work will be three months from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the tender documents.
4. The site for the work is available

   OR

   The site for the work shall be made available in parts as specified below:-

   a) Tender document consisting of plans, specifications, the schedule of quantities of the various classes of work to be done and the set of terms & conditions of contract to be downloaded from website .
5. i) Tenders shall be accompanied with tender cost of Rs 500/- in form of Demand Draft in favour of Registrar, IISER Mohali.

   ii) Tenders shall be accompanied with Earnest money of Rs.80,000/- by way of Receipt Treasury Challan/Deposit at Call receipt of a scheduled bank/fixed deposit receipt of a scheduled bank/demand draft of a scheduled bank issued in favour of the Registrar, IISER Mohali, Payable at Chandigarh. 50% of earnest money or Rs.20 lakh, whichever is less, will have to be deposited in the shape prescribed above and balance amount of earnest money can be accepted in the form of Bank guarantee issued by a scheduled bank having validity for 6 months or more from the last date of receipt of tenders

6. The contractor whose tender is accepted, will be required to furnish performance guarantee of 5% (Five Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs.10000/-) or Deposit at Call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs.1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the prescribed form. In case the contractor fails to deposit the said performance guarantee within the period as indicated in Schedule 'F'. including the extended period if any, the Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor.

Tenderers are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their tender. A tenderer shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The tenderer shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which stores, tools and plant, etc. will be issued to him by the Institute and local conditions and other factors having a bearing on the execution of the work.

7. The competent authority does not bind itself to accept the lowest or any other tender and reserves to itself the authority to reject any or all the tenders received without the assignment of any reason. All tenders in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.

8. Canvassing whether directly or indirectly, in connection with tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.

9. The competent authority reserves to himself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rate quoted.

10. The contractor shall not be permitted to tender for works in the Institute's Engineering Department (responsible for award and execution of contracts) in which his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of Executive Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relative to any Group A & B officer in the Institute's Engineering Department. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Institute/debarring for further tendering in the Institute for at least 5 years.

11. No Engineer or other officers employed in Engineering or Administrative duties in Engineering Department of the Institute is allowed to work as a contractor for a period of one year after his retirement from Institute's service without the previous permission of the competent authority in writing. This contract is liable to be canceled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of the competent authority as aforesaid before submission of the tender or engagement in the contractor's service.

12. The tender for the works shall remain open for acceptance for a period of One hundred twenty (120) days from the date of opening of tenders/ One hundred twenty days from the date of opening of financial bid in case tenders are invited on 2/3 envelop system (strike out as the case may be) if any tenderer withdraws his tender before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not

acceptable to the department, then the Institute shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the tenderer shall not be allowed to participate in the re-tendering process of the work.

13. This Notice inviting tender shall form a part of the contract document. The successful tenderer/ contractor, on an acceptance of his tender by the Accepting Authority, shall within 15 days from the stipulated date of start of the work sign the contract consisting of:

a) The Notice Inviting Tender, all the documents including additional conditions, specifications and drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

b) Standard Form 7/8.

For Composite Tenders

16.1.1 The Engineer Incharge of the major component will call tenders for the composite work. The cost of tender document and Earnest Money will be fixed with respect to the combined estimated cost put to tender for the composite tender.

16.1.2 The tender document will include following three components:

Part A:- Form-6, Form-7/8 including schedule A to F for major component of the work, Standard General Conditions of Contract or latest edition as applicable with all amendments/modifications.

Part B:- General/specific conditions, specifications and schedule of quantities applicable to major component of the work.

Part C: Schedule A to F for minor component of the work. (Engineer in charge of major component shall also be competent authority under clause 2 and clause 5 as mentioned in schedule A to F for major components) General/specific conditions, specifications and schedule of quantities applicable to minor component(s) of the work.

16.1.3The tenderer must associate with himself, agencies of the appropriate class eligible to tender for each of the minor component individually.

The eligible tenderers shall quote rates in terms of overall percentage above or below the total estimated amount put to tender must be filled both in figures and words on the last page of schedule of quantities. It will be obligatory on the part of the tenderer to sign the tender document for all the components (The schedule of quantities, conditions and special conditions etc.)

16.1.5 After acceptance of the tender by competent authority, the Engineer in charge of major component of the work shall issue letter of award on behalf of the Director. After the work is awarded, the main contractor will have to enter into one agreement with Engineer in charge of major component and has also to sign two or more copies of agreement depending upon number of Engineer Incharge of minor components. One such signed set of agreement shall be handed over to Engineer in charge of minor component. Engineer Incharge of major component will operate part A and part B of the agreement. Engineer in charge of minor component(s) shall operate Part C along

with Part A of the agreement.

16.1.6 Entire work under the scope of composite tender including major and all minor components shall be executed under one agreement.

16.1.7 Security Deposit will be worked out separately for each component corresponding to the estimated cost of the respective component of works. The Earnest Money will become part of the security deposit of the major components of work.

16.1.8 The main contractor has to associate agency(s) for minor component(s) conforming to eligibility criteria as defined in the tender document and has to submit detail of such agency(s) to Engineer-in-charge of minor component(s) within prescribed time. Name of the agency(s) to be associated shall be approved by Engineer-in-charge of minor component(s).

16.1.9 In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge of minor component. The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the contractor to change the agency executing such items of work and this shall be binding on the contractor.

16.1.10 The main contractor has to enter into agreement with the contractor(s) associated by him for execution of minor component(s). Copy of such agreement shall be submitted to Hospital Engineer in charge of each minor component as well as to Engineer in charge of major component. In case of change of associate contractor, the main contractor has to enter into agreement with the new contractor associated by him.

16.1.11 Running payment for the major component shall be made by Engineer-in-Charge of major discipline to the main contractor. Running payment for minor components shall be made by the Engineer-in-Charge of the discipline of minor component directly to the main contractor.

16.1.12 Final bill of whole work shall be finalized and paid by the Engineer-in-Charge of major component. Engineer(s) in charge of minor component(s) will prepare and pass the final bill for their component of work and pass on the same to the Engineer-in-Charge of major component for including in the final bill for composite contract.

16.1.13 It will be obligatory on the part of the tenderer to sign the tender document for all the components before the first payment is released.

No price preference to any corporate society/Registered society, Govt. Public Sector undertakings / bodies shall be given and tenders shall be exclusively dealt with on merit.

The contractor shall comply with the provisions of the Apprentices Act 1961, minimum wages Act 1948, Workmen's compensation Act 1923, contract labour (Regulation and Abolition Act 1970), payment of wages Act 1938, Employer's liability Act 1938, Maternity Benefits Act 1961, and the Industrial disputes Act 1947 as applicable and the rules and regulations issued there under and by the local Administration / Authorities from time to time as well all provisions of law applicable to workmen. Failure to do so shall amount to breach of the contract and the Engineer-in-Charge may

at his discretion terminate the contract. The Contractor shall also be liable for any pecuniary liability arising on account of violation by him of any of the said Acts and shall indemnify the Institute on that account. Institute will not be liable for any act or omission on the part of the contractor in so far as any violation of any of the aforementioned acts.

Each tenderer shall submit only one tender; either by him or as partners in a joint venture. A tenderer who submits or participates in more than one tender will be disqualified.

Unless otherwise stated, the contract shall be for the whole work as described in the "Schedule of items of Works" and the drawings. The contractor shall be bound to complete the whole work as described in the schedule of items of works and the drawings, including additional items, if any, as per drawings and instructions. The issuance of certificate of completion as issued by the Engineer-in-Charge shall be mandatory and will be conclusive proof of completion of work.

Interpretations, corrections and changes to the Tenders Documents shall be made by Addendum, if required at E-Procurement portal on https://eprocure.gov.in/eprocure/app

Each Tenderer shall ascertain prior to submitting his Tender that he has received all Addenda issued and he shall so acknowledge their receipt in his Tender.

Bidder shall submit the documents in .pdf format:

i) Demand draft/Deposit at call receipt from a Scheduled Bank towards earnest money.
ii) Partnership deed or Registration Certificate of the Firm or Company as the case may be.
iii) Power of Attorney

The provisions in the Tender documents shall govern over the contents of the above paragraphs if in contradiction or variation.

The contractor shall comply with the provisions of prevalent ESI Act.

Annexure-A

TENDER ACEPTANCE LETTER

(To be given on Company Letter Head)

Date:

To,

Executive Engineer

IISER Mohali

Sub: Acceptance of Terms and Conditions of Tender.

Tender Reference No.: IISER/EE-EO/Estimate-P/17-18/08

Name of Tender/Work:-Setting up of research labs of Dr Indranil Banerjee & Dr S Rakshit with provision of class 10000 air quality at IISER Mohali.

Dear Sir

1. I/We have downloaded/obtain the tender documents(s) from the above mentioned Tender/Work from the website(s) namely:

as per your advertisement, given in the above mentioned website(s).

2. I/We hereby certify that I/We had read the entire terms and conditions of the tender documents (including all documents like annexure(s), schedule(s), etc.) which from part of the contract agreement and I/We shall abide hereby by the terms/conditions/clauses contained therein.

3. The corrigendum(s) issued from time to time by your department/organization too have also been taken into consideration, while submitting the acceptance letter.

4. I/ We hereby unconditionally accept the tender conditions of above mentioned tender document(s) in its totality/entirety.

5. In case any provision of this tender are found violated, then your department/organization shall without prejudge to any other right or remedy be at liberty to reject this tender/bid including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,

(Signature of the bidder, with official seal)

General Rules and Directions

General Rules & Directions

General Rules & Directions

1. All works proposed for execution of contract will be notified in a form of invitation to tender posted on eprocure website.

This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tenderer, and the amount of the security deposit and performance guarantee to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills: Copies of the specifications, designs and drawings and any other documents required in connection with the work signed for the purpose of identification by the officer inviting tender shall also be opened for inspection by the contractor at the office of officer inviting tender during office hours.

2. In the event of the tender being submitted by a firm, it must be singed separately by each partner thereof or in the event of the absence of any partner, it must be singed on his behalf by a person holding a power-of attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.

3. Receipts for payment on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.

Application for item Rate Tender only (Form– 8)

4. Any person who submits a tender shall fill up the usual printed form, stating at what rate he is willing to undertake each item of the work. Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates will be summarily rejected. No single tender shall include more than one work, but contractors who wish to tender for two or more works shall submit separate tender for each. Tender shall have the name and number of the works to which they refer, written on the envelopes.

The rate(s) must be quoted in decimal coinage. Amounts must be quoted in full rupees by ignoring fifty paise and considering more than fifty paise as rupee one.

Applicable for Percentage Rate Tender only (Form- 7)

4 A. In case of Percentage Rate Tenders, tenderer shall fill up the usual printed form, stating at what percentage below/above (in figures as well as in words) the total estimated cost given in Schedule of Quantities at Schedule –A, he will be willing to execute the work. The tenders submitted shall be treated as invalid if:

(i) The contractor does not quote percentage above/below on the total amount of tender or any section/sub head of the tender.

(ii) The percentage above/below is not quoted in figures & words both on the total amount of tender or any section/sub head of the tender.

(iii) The percentage quoted above/below is different in figures & words on the total amount of tender or any section/sub head of the tender:-

Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates, will be summarily rejected. No single tender shall include more than one work, but contractors who wish to tender for two or more works shall submit separate tender for each. Tender shall have the name and number of the works to which they refer, written on the envelopes.

4B. In case the lowest tendered amount (estimated cost + amount worked on the basis of percentage above/below) of two or more contractors is same, such lowest contractors will be asked to submit sealed revised offer in the form of letter

mentioning percentage above/below on estimated cost of tender including all sub sections/sub heads as the case may be, but the revised percentage quoted above/below on tendered cost or on each sub section/sub head should not be higher than the percentage quoted at the time of submission of tender. The lowest tender shall be decided on the basis of revised offers.

In case any of such contractor refuses to submit revised offer, then it shall be treated as withdrawal of his tender before acceptance and 50% of earnest money shall be forfeited.

If the revised tendered amount of two or more contractors received in revised offer is again found to be equal , the lowest tender, among such contractors, shall be decided by draw of lots in the presence of Engineer-in-charge of major & minor component(s) (also Director, IISER in case Horticulture work is also included in the tender).

In case all the lowest contractors those have quoted same tendered amount, refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD of each contractor.

Contractor(s), whose earnest money is forfeited because of non- submission of revised offer, shall not be allowed to participate in the re-tendering process of the work.

5. The officer inviting tender or his duly authorized assistant will open tenders in the presence of any intending contractors who may be present at the time, and will enter the amounts of the several tenders in a comparative statement in a suitable form. In the event of a tender being accepted, a receipt for the earnest money shall thereupon be given to the contractor who shall thereupon for the purpose of identification sign copies of the specifications and other documents mentioned in Rule-I. In the event of a tender being rejected, the earnest money shall thereupon be returned to the contractor remitting the same, without any interest.

6. The officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.

7. The receipt of an accountant or clerk for any money paid by the contractor will not be considered as any acknowledgment or payment to the officer inviting tender and the contractors shall be responsible for seeing that he procures a receipt signed by the officer inviting tender or a duly authorized Cashier.

8. The memorandum of work tendered for and the schedule of materials to be

supplied by the department and their issue-rates, shall be filled and completed in the office of the officer inviting tender before the tender form is issued. If a form is issued to an intending tenderer without having been so filled in and incomplete, he shall request the officer to have this done before he completes and delivers his tender.

9. The tenderer shall sign a declaration under the officials Secret Act 1923, for maintaining secrecy of the tender documents drawings or other records connected with the work given to them. The unsuccessful tenderer shall return all the drawings given to them.

9A. Use of correcting fluid, anywhere in tender document is not permitted. Such tender is liable for rejection.

Applicable for Item Rate Tender only (Form- 8)

10 In the case of Item Rate Tenders, only rates quoted shall be considered. Any tender containing percentage below/above the rates quoted is liable to be rejected. Rates quoted by the contractor in item rates tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures and words. However, if a discrepancy is found, the rates which correspond with the amount worked out by the contractor shall unless otherwise proved be taken as correct. If the amount of an item is not worked out by the contractor or it does not correspond with the rates written either in figures or in words then the rates quoted by the contractor in words shall be taken as correct. Where the rates quoted by the contractor in figures and in words tally but the amount is not worked out correctly, the rates quoted by the contractor will unless otherwise proved be taken as correct and not the amount. In even no rate has been quoted for any item(s), leaving space both in figure(s), word(s) and amount blank, it will be presumed that the contractor has included the cost of this/these item(s) in other items and rate for such item(s) will be considered as zero and work will be required to be executed accordingly.

Applicable for Percentage Rate Tender only (Form- 7)

10A. In case of Percentage Rate Tenders only percentage quoted shall be considered. Any tender containing item rates is liable to be rejected. Percentage quoted by the contractor in percentage rate tender shall be accurately filled in figures and words, so that there is no discrepancy.

11. In the case of any tender where unit rate of any item/items appear unrealistic, such tenders will be considered as unbalanced and in case the tenderer is unable to provide satisfactory explanation such a tender is liable to be disqualified and rejected.

Applicable for Item Rate Tender only (Form- 8)

12. All rates shall be quoted on the tender form. The amount for each item should be worked out and requisite totals given. Special care should be taken to write the rates in figures as well as in words and the amount in figures only, in such a way that interpolation is not possible. The total amount should be written both in figures and in words. In case of figures, the word 'Rs.' should be written before the figure of rupees and word 'P' after the decimal figures, e.g. 'Rs. 2.15 P' and in case of words, the word, 'Rupees' should precede and the word 'Paise' should be written at the end. Unless the rate is in whole rupees and followed by the word 'only' should invariably be upto two decimal places. While quoting the rate in Schedule of quantities, the word only should be written closely following the amount and it should not be written in the next line.

Applicable for Percentage Rate Tender only (Form- 7)

12A.In Percentage Rate Tender, the tenderer shall quote percentage below/above (in figures as well as in words) at which he will be willing to execute the work. He shall also work out the total amount of his offer and the same should be written in figures as well as in words in such a way that no interpolation is possible. In case of figures, the words 'Rs' should be written before the figures of rupees and word P after the decimal figures, e.g. 'Rs. 2.15P and in case of words, the word 'Rupees' should precede and the world 'Paise' should be written at the end.

13.(i) The Contractor whose tender is accepted, will be required to furnish performance guarantee of 5% (Five Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of Deposit at call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the prescribed form.

(ii) The contractor whose tender is accepted will also be required to furnish by way of Security Deposit for the fulfillment of his contract, an amount equal to 5% of the tendered value of the work. The Security deposit will be collected by deductions from the running bills of the contractor at the rates mentioned above and the earnest money deposited at the time of tenders, will be treated as a part of the Security Deposit. The Security amount will also be accepted in the shape of Government Securities. Fixed Deposit Receipt of a Scheduled Bank or State Bank of India

will also be accepted for this purpose provided confirmatory advice is enclosed.

14. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from Engineer-in-Charge shall be communicated in writing to the Engineer-in-Charge.

15.Sales-tax/VAT, purchase tax, turnover tax or any other tax on material in respect of this contract shall be payable by the Contractor and the Institute will not entertain any claim whatsoever in respect of the same. However, GST as applicable shall be paid by furnishing the proof of having depositing the same with the Govt.

16. The contractor shall give a list of employees in IISER related to him.

17. The tender for the work shall not be witnessed by a contractor or contractors who himself/themselves has/have tendered or who may and has/have tendered for the same work. Failure to observe this condition would render, tenders of the contractors tendering, as well as witnessing the tender, liable to summary rejection.

18. The tender for composite work includes in addition to building work all other works such as sanitary and water supply installations drainage installation, electrical work, horticulture work, roads and path etc. The tenderer apart from being a registered contractor (B & R) of appropriate class, must associate himself with agencies of appropriate class which are eligible to tender for sanitary and water supply drainage, electrical and horticulture work in a composite tender subject to the approval of the institute.

19. The contractor shall submit list of works which are in hand (Progress) in the following form:-

Name of work	Name and particulars of divn. Where work is being executed	Value of work	Position of works in progress	Remarks
1	2	3	4	5

20. The contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract

and the Engineer Incharge may in his discretion without prejudice to any other right or remedy available in law cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

21. Every tender shall be written in the English language. All other information such as documents and drawings supplied by the tenderer will also be in the English language only. Drawings and designs shall be dimensioned according to the metric system of measurements. Tenders shall be forwarded under cover or a letter typewritten on the tenderer's letterhead and duly signed by the tenderer. Signature must be in long hand executed in ink by a duly authorized principal of the tendering firm. No oral, telegraphic or telephonic tenders or subsequent modifications there to shall be entertained.

22. The tenderer shall sign of every page of the tender documents in taken of acceptance of tender conditions and for the purpose of identification. Tenders containing erasures and alterations of the tender documents are liable to the rejected unless these are authenticated by the person signing the Tender Documents.

23. The tenderer shall not be entitled to claim any costs, charges, expenses in connection with preparation and submission and subsequent clarification of his tender in the event of withdrawal of the invitation of tenders by the Institute.

24. The institute reserves the right to revise or amend the tender documents prior to the date notified for opening of the tenders and also the right to postpone the date of presentation and opening of tenders without assigning any reason, whatsoever.

25. The Director IISER, Mohali shall be referred as "Institute" in all the documents of Notice Inviting Tender/Contract Agreement.

26. Wherever the word 'Engineer-in –Charge occurs it shall mean Executive Engineer of IISER Mohali.

Annexure-B

Instructions for Online Bid Submission:

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.

REGISTRATION

1) Bidders are required to enroll en the e-Procurement module of the Central Public Procurement (https://eprocure.gov.in/eprocure/app) by clicking on the link "Online bidder :Enrollment" on the CPP Portal which is free of charge.
2) As part of the enrolment process, the bidders will be required to choose a unique username as assign a password for their accounts.
3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with Signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC /e-Token.

SEARCH FOR TENDER DOCUMENTS

1) There are various search option built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.
1) Once the bidders having selected the tenders they are interested in, they may download the required documents / tender schedules. The tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e- mail in case there is any corrigendum issued to the tender document.
2) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification I help from the Helpdesk.

PREPARATION OF BIDS

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

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

3) Bidder, in advance, should get ready the bid documents to be' submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF / JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

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

SUBMISSION OF BIDS

1. Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

2 The bidder has to digitally sign and upload the required bid documents one by erne as indicated in the tender document.

3 Bidder has to select the payment option as "offline" to pay the tender fee / EMD as applicable and enter details of the instrument,

4 Bidder should prepare the EMD as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents. The details of the DO/any other accepted instrument, physically sent *r* should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.

5. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

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

7. All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid openers public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.

8. The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
9. Upon the successful and timely submission of bids (i.e after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
10. The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

ASSISTANCE TO BIDDERS

1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.
2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.

Tenderer's to study entire tender document carefully

a) Submission of a tender by a tenderer implies that he has read all the stipulations contained in this tender document and all other contract documents and has acquainted himself of the nature, site conditions scope and specifications of the works to be executed and of conditions and rates at which stores will be issued to him by the IISER. The contractor shall also be deemed to have acquainted himself will local conditions and other factors which have a bearing on the execution of the works.

b) Before submitting the tender for the work to IISER, the tenderer should thoroughly examine the existing conditions of site

c)After award of the work contractor has to prepare and submit the shop drawings (only for air-conditioning / fabrication work) for approval of the Engineer-in-charge.

d)No claim will be entertained on account of ignorance of site conditions.

Condition of contract

1. The Contract means the documents forming the tender and acceptance thereof and the formal agreement executed between competent authority on behalf of the Director, IISER and the contractor, together with the document referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by Engineer-in-charge and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.
2. In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:-

I) The expression works or work shall unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

ii) The site shall mean the land/ or other places on into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

iii) The contractor shall mean the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such, individual, firm or company.

iv) The Institute means the Director, IISER and his successors.

v) The Engineer-in-charge means the Executive Engineer who shall supervise and be in-charge of the work and who shall sign the contract on behalf of the Director, IISER Mohali mentioned in schedule 'F' hereunder.

vi) Institute shall mean the Director IISER, Mohali.

vii) Administration shall mean the administration of the IISER Mohali.

viii) Local authority shall mean the municipal corporation of Mohali and shall also deemed to include any other body or department of the administration.

ix) Accepting Authority shall mean the authority mentioned in Schedule 'F'

x) Excepted Risk are risks due to riots (Other than those on account of contractor's employees) war (Whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Institute damages from aircraft, act of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by the Institute of part of the works in respect of which a certificate of completion has been issued or a cause solely due to the Institute's faulty design of works.

xi) Market Rate shall be the rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits.

xii) Schedule(s) referred to in these conditions shall mean the relevant
schedule (s) annexed to the tender papers or the standard Schedule of Rates of the Institute mentioned in Schedule 'F' hereunder, with the amendments thereto issued upto the date of receipt of the tender.

xiii) Department means Director, IISER or any Division of IISER which invites tenders on behalf of Institute as specified in the Schedule 'F'.

xiv) Tendered value means the value of the entire work as stipulated in the letter of award.

xv) Date of commencement of work: The date of commencement of work shall be the date of start as specified in schedule 'F' or the first date of handing over of the site, whichever is later, in accordance with the phasing if any, as indicated in the tender documents.

Scope

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

4.Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into considerations in the interpretation or construction thereof or of the contract.

5.The contractor shall be furnished, free of cost one certified copy of the contract documents except standard specifications, schedule of Rates and such other printed and published documents, together with all drawings as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.

Works to be Carried out:

6. The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities (Schedule-A) shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting setting, fitting and fixing in position and all other labors necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.

Sufficiency of Tender

7. The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

8.2 If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding authority with regard to the intentions of the document and his decision shall be final and binding on the contractor.

8.3 Any error in description, quantity or rate in schedule of Quantities or any omission there from shall not vitiate the contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

Signing of Contract

9. The successful tenderer/ contractor on acceptance of his tender by the Accepting authority, shall within 15 days from the stipulated date of start of the work sign the contract consisting of:-

i) The notice inviting tender, all the documents including drawings, if any forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

ii) Standard form as mentioned in Schedule 'F' consisting of:

a) Various standard clauses with corrections upto the date stipulated in Schedule 'F' along with annexure thereto.

b) Safety Code.

c) Model Rules for the protection of health, sanitary arrangements for workers employed by the contractor.

d) Contractor's Labour Regulations.

e) List of Acts and omissions for which fines can be imposed.

iii) No payment for the work done will be made unless contract is signed by the contractor.

5.0

PROFORMA OF SCHEDULE A TO F

(Separate Performa for Civil, Elect. & Hort. Works in case of Composite Tenders)
(Operative Schedules to be supplied separately to each intending tenderer)

SCHEDULE 'A'

Schedule of quantities (enclosed)

SCHEDULE 'B'

Schedule of material to be issued to the contractor

S.R	Description of item	Quantity	Rate in figure and words at which the material will be charged to the contractor.	Place of Issue.

SCHEDULE 'C'

Tools and plants to be hired to the contractor.

Sr. No.	Description	Hire charges per day	Place of issue

SCHEDULE 'D'

Extra schedule for specific requirements/ documents for the work if any.

SCHEDULE 'E'

Reference to General Conditions of contract.

Name of Work : Setting up of research labs of Dr Indranil Banerjee & Dr S Rakshit with provision of class 10000 air qualityat IISER Mohali.

Estimated cost of work : Rs. 39,60,799/-

Earnest Money : Rs.80,000/-

(ii) Performance Guarantee : 5% of tendered value

(iii) Security Deposit : 5% of tendered value

SCHEDULE 'F'

REFERENCE TO GENERAL CONDITION OF CONTRACT

	GENERAL RULES & DIRECRTIONS	**Officer inviting tender**
	Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 & 12.3:	See below
	Definations:	
2 (v)	Engineer- in- charge	Executive Engineer, IISER, Mohali.
2 (viii)	Accepting Authority	Director, IISER .
2 (x)	Percentage on cost of material and labour to cover all overheads and profits	15%
2 (xi)	Standard Schedule of Rates	DSR and market rates.
2 (xii)	Department	IISER Mohali
9 (ii)	Standard contract Form	General Conditions of Contract

Clauses of Contract

Clause 1		
(i)	Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance	15 days
(ii)	Maximum allowable extension beyond the period provided in (i) above	
Clause 2		
	Authority for fixing compensation under clause-2	Director IISER, Mohali.
Clause 2A	Whether Clause 2A shall be applicable	Yes / No
Clause 5		
	Number of days from the date of issue of letter of acceptance for reckoning date of start	7 days

Mile stone(S) as per table given below:-

S. No.	Description of Milestone (Physical)	Time allowed in days (from date of start)	Amount to be withheld in case of non-achievement of milestone

Time allowed for execution of work, Three month

Authority to decide:

(i)	Extension of time	Director IISER
(ii)	Rescheduling of mile	Director IISER Mohali

Clause 6, 6A — Clause applicable - (6 or 6A) .....

Clause 7 — Gross work to be done together with net payment /adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment — Rs. .....

Clause 10A

List of testing equipment to be provided by the contractor at site lab

1	2	3
4	5	6

Clause 10C

Component of labour expressed as percent of value of work = ... %

Clause 10CA

S.No.	Material covered under this clause	Nearest Materials (other than cement, reinforcement bars and the structural steel) for which All India Wholesale Price Index to be followed	Base Price of all Materials covered under clause 10 CA*

* Base price of all the materials covered under clause 10 CA is to be mentioned at the time of approval of NIT.

Clause 10CC

Clause 10 CC to be applicable in contracts with stipulated period of completion exceeding the period shown in next column	Not applicable
Schedule of component of other Materials,	Not applicable
Component of civil (except materials covered under clause 10CA) /Electrical construction Materials expressed as percent of total value of work. -	Not applicable
Component of Labour - expressed as percent of total value of work.	Not applicable
Component of P.O.L. - expressed as percent of total value of work.	Not applicable

Clause 11	Specifications be followed for execution of work.	i) NIT Specifications. ii) CPWD specifications with upto date amendments iii) Bureau of Indian Standards wherever no such specifications exists in S.No. i) & ii)

Clauses 12		
12.2 & 12.3	Deviation limit beyond which clause 12.2 & 12.3 shall apply for building work	30%
12.5	Deviation limit beyond which clause 12.2 & 12.3 shall apply for foundation work	30%

Clause 16

Competent authority for deciding reduced rates — Director, IISER, Mohali.

Clause 18

List of mandatory machinery, tools & plants to be deployed by the contractor at site:-

1 ……...	2……	3……
4 ……...	5……...	6……...
7 ……...	8……...	9……...

Clause 36 (i)

Requirement of Technical Representative(s) and recovery Rate

SN	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical/ Technical Representative)	Minimum Expenditure	Number	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i)	
						Figures	Words

Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers

Clause 42

(i) (a)	Schedule/statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule of Rates	printed by C.P.W.D.
(ii)	Variations permissible on theoretical quantities: (a) Cement	
	For works with estimated cost put to tender not more than Rs. 5 lakh.	NA
	For works with estimated cost put to tender more than Rs.5 lakh.	NA
(iii)	Bitumen for all works	NA
(iv)	Steel reinforcement and structural steel sections for each diameter, section and category	NA
(v)	All other materials	NIL

Recovery rates for quantities beyond permissible variation

Sr. No.	Description of Item	Rates in figures and words at which recovery shall be made from the contractor	
		Excess beyond permissible variation	Less use beyond the permissible variation.
1.	Cement		
2.	Steel reinforcement		
3.	Structural sections		
4.	Bitumen issued free		
5.	Bitumen issued at stipulated fixed price.		

Preferred Makes

1. VRV machines- Daikin/Samsung/Mitsubishi Electric/Toshiba/LG
2. AHU- Edge Tech/Zeco
3. PVC Pipe (Heavy Grade)- Reliance/Finolex/Astra
4. Copper Pipe- Totaline/Mehtatube
5. Grills/Difusers- Caryaire/Ravistar/Airflow/Coolwings
6. Insulation- K Flex/ A Flex/ Armacell
7. Ducting- Eco/ ZECO/ROLASTAR
8. Inline fan- Systemair/Kanalflakt/Kruger/Ostberg/Backward Curve
9. Cables- Polycab/Finolex/Echo

SPECIFICATION FOR HVAC WORK

1(a) The definition of terms used in these specifications shall be in accordance with IS: 3615.

1(b) Site Information

The tenderer should, in his own interest, visit the site and familiarize with the site conditions before tendering. For any clarification, tenderer may discuss with the Consultant / customer.

1(c) Heat Load Calculations and Equipment Selection

i) The tenderer should give detailed heat load calculations wherever required separately for all the seasons in which, the specified conditions are to be maintained.

ii) The equipment selection shall be made on the basis of the above heat load calculations wherever required.

1(d) CONFORMITY WITH STATUTORY ACTS, RULES, STANDARDS AND CODES

i) All components shall conform to relevant Indian Standard Specifications, wherever existing, amended to date.

ii) All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended to date.

1(e) SAFETY CODES AND LABOUR REGULATIONS

i) In respect of all labour employed directly or indirectly on the work for the performance of the air conditioning contractor‟s part of work, the contractor at his own expense, will arrange for the safety provisions as per the statutory provisions,

B.I.S. recommendations, factory act, workman‟s compensation act, instructions issued from time to time. Failure to provide such safety requirements would make the tenderer liable for penalty for each violation. In addition the customer, shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost from the contractor.

iii) The contractor shall provide necessary barriers, warning signals and other safety measures while laying pipelines, ducts cables etc. or wherever necessary so as to avoid accident. He shall also indemnify OWNER against claims for compensation arising out of negligence in this respect. Contractor shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause. The Owner shall not be responsible for any

accident occurred or damage incurred or claims arising there from during the execution of work. The contractor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the contractor due to the above provisions thereof.

1(f) WORKS TO BE ARRANGED BY THE OWNER

Unless otherwise specified in the tender documents, the following works shall be arranged by the Owner:

i) Space for accommodating all the equipment and components involved in the work,

ii) Power supply, Water supply and Drain points as per para 1(h).

iii) Masonry ducts within and outside the building for carrying pipe lines and cables wherever specified.

1(g) WORKS TO BE DONE BY THE CONTRACTOR

Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall be deemed to be included in their tendered cost- whether specifically indicated in the schedule of work or not: -

i) Foundation bolts and vibration isolation spring/pads,

ii) Suspenders, brackets and floor/ wall supports for suspending / supporting ducts and pipes,

iv) Suspenders and/or cable trays for laying the cables,

v) Painting of all exposed metal surfaces of equipments and components with appropriate colour.

vi) Making openings in the walls/ floors/ slabs or modification in the existing openings wherever provided for carrying pipe line, ducts, cables etc.

vii) Providing wooden/ metallic frames for fixing grills/ diffusers

1(h) POWER SUPPLY, WATER SUPPLY AND DRAINAGE

i) Unless otherwise specified, 3 phase, 415 volts, 50 Hz power supply shall be provided by the Owner free of charge to the contractor at one point for installation at site. Termination switchgear however, shall be provided by the contractor. Further extension if required shall be done by the contractor.

ii) The power supply for testing and commissioning of the complete installation shall be made available free of charge to the contractor. The termination of feeder in the main incomer unit shall be the responsibility of the contractor and nothing extra shall be paid on this account. Further power distribution to the various equipments shall be done by the contractor.

iii) The contractor shall not use the power supply for any other purpose than that for which it is intended for. No major fabrication work shall be done at site. Power shall be used only for welding / cutting works. The power supply shall be disconnected in case of such default and the contractor shall then have to arrange the required power supply at his cost.

v) Wherever there is a possibility of lower supply voltage, which does not allow motors to be operated, necessary voltage correction devices like HT voltage regulator/ ON- Load tap changer/ Servo Stabilizer etc may be provided to ensure proper voltage.

vi) Power supply shall also be backed by suitable standby DG set. It is necessary to provide stand by supply to fan motors of all AHUs, to ensure air circulation in air conditioning areas when the AC plant is not working due to non availability of

normal electrical supply. Additionally where the air conditioning is a functional/ critical requirement such as hospitals, computer centers, labs etc, provision shall be made by the Owner for operation of suitable number of chilling units on standby power supply.

1(i) WATER SUPPLY

i) Water supply shall be made available to the contractor free of charge at only one point for installation. Further extension if required shall be done by the contractor.

ii) Water shall be made available by the Owner free of charge in makeup water tank near the cooling tower, AC plant room, AHU room, expansion tank, hot water generator, air washer, etc. as required for testing and commissioning. Further connection from makeup water tank to cooling tower shall be carried out by the contractor and shall be separately measured & paid for as per contract.

iii) Water analysis should be obtained of the water available at site and if required water softening plant may be provided.

1(j) DRAINAGE

i) Piping Connections from the equipment to the drain trap including providing valves at the drain points shall be done by the contractor. These items of work shall be separately measured and paid as per contract.

1(k) MACHINERY FOR ERECTION

All tools and tackles required for unloading / handling of equipments and materials at site, their assembly, erection, testing and commissioning shall be the responsibility of the contractor.

1(l) COMPLETENESS OF THE TENDER, SUBMISSION OF PROGRAMME, APPROVAL OF DRAWINGS AND COMMENCEMENT OF WORK

i) Completeness of the tender

All sundry equipments, fittings, assemblies, accessories, hardware items, foundation bolts, supports, termination lugs for electrical connections, cable glands, junction boxes and all other items which are useful and necessary for proper assembly and efficient working of the various equipments and components of the work shall be deemed to have been included in the tender, irrespective of the fact whether such items are specifically mentioned in the tender or not.

ii) Submission of program

Within fifteen days from the date of receipt of the letter of acceptance, the successful tenderer shall submit his program for submission of drawings, supply of equipment, installation, testing, commissioning and handing over of the installation to the Consultant / customer. This program shall be framed keeping in view the building progress. Items like ducting, piping etc. that directly affect the building progress shall be given priority.

iii) Submission of Drawings

The contractor shall submit the drawings to the consultant / architect for approval before start of work.

iv) Commencement of Work

The contractor shall commence work as soon as the drawings submitted by him are approved.

1(m) DISPATCH OF MATERIALS TO SITE AND THEIR SAFE CUSTODY

The contractor shall dispatch materials to site in consultation with the customer / consultant / architect. Suitable lockable storage accommodation shall be made available free of charge temporarily. Watch & ward however, shall be the responsibility of contractor. Program of dispatch of material shall be framed keeping in view the building progress. Safe custody of all machinery and equipment supplied by the contractor shall be the responsibility of the contractor till final taking over by the Owner.

1(n) CO-ORDINATION WITH OTHER AGENCIES

The contractor shall co-ordinate with all other agencies involved in the work so that the work of other agencies is not hampered due to delay in his work. Ducting, piping, cabling or any other work, which directly affect the progress of building work, shall be given priority.

1(o) QUALITY OF MATERIALS AND WORKMANSHIP

i) The components of the installation shall be of such design so as to satisfactorily function under all conditions of operation.

ii) The entire work of manufacture/fabrication, assembly and installation shall conform to sound engineering practice. The entire installation shall be such as to cause minimum transmission of noise and vibration to the building structure.

iii) All equipments and materials to be used in work shall be manufactured in factories of good repute having excellent track record of quality manufacturing, performance and proper after sales service.

1(p) CARE OF THE BUILDING

Care shall be taken by the contractor during execution of the work to avoid damage to the building. He shall be responsible for repairing all such damages and restoring the same to the original finish at his cost. He shall also remove all unwanted and waste materials arising out of the installation from the site of work from time to time.

2 IMPORTANT INSTRUCTIONs:

All works to be carried out with prior approval from the Institute.
The lowside vendor shall be responsible for the final design conditions as provided in System Design Chapter, he shall be carrying out all heat loads, checking with physical actual site conditions and shall confirm the same with 10 days of obtaining of LOI. He shall bring out clearly any discrepancy from the design and actual conditions. He shall also coordinate the same with high side vendor. Only upon approval of design the work shall be carried out.

The vendor shall submit all actual working drawings, with plans, sections etc within a maximum of 15 days from the date of LOI.

All SLDs and panel GA drawings shall be approved before fabrication to begin by Engineer in charge.

The vendor shall also be coordinating with the civil contractor and give actual cutout requirement. Any wastage/ damage to the partitions shall be recovered from the vendors running bills.

All Ducting shall be factory fabricated barring few exceptions which are unavoidable.

SPECIAL CONDITIONS OF CONTRACT

1 General: These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply. Notwithstanding the sub-division of the documents into separate sections and volumes, every part shall be deemed to be supplementary to and complementary of every other part of each shall be read with and into the contract so far as it may be practicable to do so Where any portion of the general conditions of contract is repugnant to or at variance with any provision of the special conditions of contract, then unless a different intention appears, the provision(s) of special condition of contract shall be deemed to override the provision(s) of general conditions of contract only to the extent that such repugnance or variance cannot be reconciled with the general conditions of contract and shall be to the extent of such repugnance of variations, prevail; it being understood that the provisions of general conditions of contract shall otherwise prevail.

2. Scope of Work: The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer in Charge. The contractor shall furnish all labour, materials and equipment (except those to be supplied by the Owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete air conditioning system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings / Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The central Heating, Ventilation and Air-Conditioning (HVAC) system shall comprise of following:

a. Fresh air fans

b. Motor control centers, Wiring and earthing from MCC panels to various air conditioning equipment, control wiring and interlocking.

c. Sheet metal ducts inclusive of external insulation, acoustic lining, canvas connections, volume control dampers and smoke dampers as required, Supply and return air registers and diffusers.

d. Wiring and earthing from MCC panels to various refrigeration, air conditioning and mechanical ventilation equipment, control wiring and interlocking.

e. Balancing, testing and commissioning of the entire HVAC and mechanical ventilation installation.

f. Test reports, list of recommended spares, as-installed drawings, operation and maintenance manual for the entire HVAC installation.

g. Training of Customer"s Staff.

3. Associated Civil Works: Following civil works associated with HVAC installation are excluded from the scope of this contract. These shall be executed by other agencies in accordance with approved shop drawings of and under direct supervision of the air conditioning contractor.

- Air-tight fire doors with minimum one hour fire rating for Air Handling unit rooms, fan rooms and other equipment rooms.
- Water proofing of floors of AHU rooms and fan rooms.
- Foundations for all HVAC equipment.

4. Associated Services Works

4.1 All associated ELECTRICAL WORKS listed below are excluded from the scope of this contract. These shall be installed by other agencies in accordance with approved shop drawings of, and under direct supervision of the air conditioning contractor.

- Providing power supply with earthing at the incoming of control panel in A/C plant room.
- Providing power supply and earthing at the incoming MCCB in each air handling unit control panel.
- Providing power and earthing at the incoming MCCB in each centrifugal fan panel and pump panel at locations called for on air conditioning Contractor"s shop drawings.
- Providing 15 amps power outlet within 2 meter reach of each fan coil unit at locations called for on air conditioning Contractor"s shop drawings.
- Providing 15 amps power outlet within 2 meter reach of each single phase propeller fan at locations called for on air conditioning contractor"s shop drawings.
- Providing wiring and earthing for sump pumps in air conditioning plant room.

4.2 All associated PLUMBING WORKS listed below are excluded from the scope of this contract. These shall be installed by other agencies, in accordance with approved shop drawings of, and under direct supervision, of the air conditioning contractor.

- Providing sump pumps and necessary piping for drainage of plant room and other machine rooms located below ground level.
- Providing floor drains in air handling unit rooms.
- Disposal of condensate drain from AHU / fan coil units beyond the condensate drain riser.

5. Project Execution and Management: The Contractor shall ensure that senior planning and erection personnel from his organisation are assigned exclusively for this project. They shall have minimum 3 years experience in this type of installation. The Contractor shall appoint

one Project manager. He shall be assisted on full time basis by erection engineers & supervisors. The entire staff shall be posted at site on full time basis.

The project management shall be through modern technique. The Contractor‟s office at site shall be fully equipped with fax, modem, computers, plotter etc. Erection engineer and supervisors shall be provided with mobile communication system so that they can always be reached.

For quality control & monitoring of workmanship, contractor shall assign at least one full- time engineer with minimum 5 years relevant experience, who would be exclusively responsible for ensuring strict quality control, adherence to specifications and ensuring top class workmanship for the air conditioning installation.

The Contractor shall arrange to have mechanised & modern facilities of transporting material to place of installation for speedy execution of work.

6. Performance Guarantee: The contractor shall carry out the work in accordance with the Drawings, Specifications, Schedule of Quantities and other documents forming part of the Contract.

The contractor shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result.

The contractor shall guarantee that the HVAC system as installed shall maintain the inside conditions in the air-conditioned spaces as described under "Basis of Design" in the specifications.

Complete set of drawings is available in the Owner / Architect / Consultant office and reference may be made to same for any details or information. The contractor shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

7. Bye-Laws and Regulations: The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned, in so far as these become applicable to the installation. But if these Specifications and Drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and Drawings shall take precedence over the said regulations and standards. However, if the Drawings and specifications require something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

8. Fees and Permits: The contractor shall obtain all permits / licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

9. Drawings: The HVAC Drawings issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These

Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The interiors drawings and details shall be examined for exact location of equipment, controls, grilles and diffusers. The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed. Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Owner / Architect / Consultant before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost. The contractor shall examine all interior, structural, plumbing, and electrical and other services drawings and check the as- built works before starting the work report to the Owner / Architect / Consultant any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Owner / Architect / consultant without additional cost to the Owner. The data given in the Drawings and Specifications is as exact as could be procured, but its accuracy is not guaranteed.

10 Technical Data: Each tenderer shall submit along with his tender, the technical data for all items. Failure to furnish complete technical data with tenders may result in summary rejection of the tender.

11. Shop Drawings:

11.1 All the shop drawings shall be prepared on computer through AutoCAD System based on Drawings, site measurements and Interior Designer"s Drawings. All heat load calculations shall be done using latest software. Within one week of the award of the contract, contractor shall furnish, for the approval of the Owner / Architect / Consultant, two sets of detailed shop drawings of all equipment and materials including layouts for Plant room, AHU rooms, fan rooms, fan coil units, ventilation fans; CFD analysis report for jet fans detailed ducting drawings showing exact location of supports, flanges, bends, tee connections, reducers, guide vanes, silencers, distribution grids, volume control dampers, collars, grilles, diffusers; detailed piping drawings showing exact location and type of supports, valves, fittings etc; acoustic lining and external insulation details for ducts, pipe insulation etc; electrical panels inside / outside views, power and control wiring schematics, cable trays, supports and terminations. These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Owner / Architect / consultant. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment / materials /

works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings. Minimum 6 sets of drawings shall be submitted after final approval along with softcopy.

Each item of equipment / material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers given in list of makes and quoted by the tenderer in technical data part.

When the Owner / Architect / Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated alongwith check prints, for approval. The contractor shall submit further six sets of shop drawings to the Owner / Architect / Consultant for the exclusive use by the Owner / Architect

/ Consultant and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material / equipment / installation.

11.2 Shop drawings shall be submitted for approval four weeks in advance of planned delivery and installation of any material to allow Owner / Architect / Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved program.

11.3 Manufacturers drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

11.4 Samples of all materials like grilles, diffusers, controls, insulation, pre-moulded pipe section, control wires etc shall be submitted to the Owner / Architect / Consultant prior to procurement. These will be submitted in two sets for approval and retention by Owner / Architect / Consultant and shall be kept in their site office for reference and verification till the completion of the Project. Wherever directed a mockup or sample installation shall be carried out for approval before proceeding for further installation.

11.5 Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

11.6 Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical layouts; all such re-design, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Owner / Architect / Consultant. Any delay on such account shall be at the cost of and consequence of the Contractor.

Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Owner/Architect/Consultant, the contractor shall prepare composite working drawings and sections at a suitable scale, not less than 1:100, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

11.8 Within two weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools, covering all equipment and materials in this contract. The Owner / Architect / Consultant shall make recommendation for acceptance of anticipated variation in contract amounts.

12. Quiet Operation and Vibration Isolation: All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Owner / Architect / Consultant. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense. The contractor shall guarantee that the equipment installed shall maintain the specified NC levels.

13. Accessibility: The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his ducting and piping. His failure to communicate insufficiency of any of the above, shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed control damper, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense. Access panel shall be standardised for each piece of equipment / device / accessory and shall be clearly marked.

14. Materials and Equipment: All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be strictly in conformity with list of approved manufacturers as per attached list.

15. Manufacturers Instructions: Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

16. Electrical Installation: The electrical work related to air conditioning services, shall be carried out in full knowledge of, and with the complete coordination of the contractor. The electrical installation shall be in total conformity with the control wiring drawings prepared by the contractor and approved by the Owner/Consultant. All air conditioning equipment shall be connected and tested in the presence of an authorized representative of the contractor. The system shall be commissioned only after the contractor has certified in writing that the electrical installation work for air cooling services has been thoroughly checked, tested and found to be totally satisfactory and in full conformity with the contract Drawings, Specifications and manufacturer‟s instructions. It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the contract requirements, of the electrical installation work for air conditioning services, lies solely with the contractor.

17. Completion Certificate: On completion of the Electrical installation for air conditioning, a certificate shall be furnished by the contractor, counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority.The contractor shall be responsible for getting the entire electrical installation for air conditioning system duly approved by the local authorities concerned, and shall bear expenses if any, in connection with the same.

18. Balancing, Testing And Commissioning : Balancing of all air and water systems and all tests as called for the Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and ASHRAE Guide lines and Standards. Performance test shall consist of three days of 10 hour each operation of system for each season. Cost of performance witness test of major equipment such as chillers, at factory with two personnel from Owners / Consultant shall be included. The results for summer, monsoon and winter air conditioning in quadruplicate shall be submitted for scrutiny. Four copies of the certified manufacturer performance curves for each piece of equipment, high lighting operational parameters for the project, shall be submitted along with the test certificates. Contractor shall also provide four copies of record of all safety and automatic control settings for the entire installation. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Owner / Architect / Consultant. All tests shall be carried out in the presence of the representatives of the Owner / Architect / Consultant.

19. As Built Drawings: Contractor shall submit as built drawings as and when work in all respects is completed in a particular area. These drawings shall be submitted in the form of two sets of CD‟s and four portfolios (300 x 450 mm) each containing complete set of drawings on approved scale indicating the work as – installed. These drawings shall clearly indicate complete plant room layouts, ducting and piping layouts, location of wiring and sequencing of automatic controls, location of all concealed piping, valves, controls, dampers, wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The contractor shall frame under glass, in the air-conditioning plant room, one set of these consolidated control diagrams.

20. Operating Instruction & Maintenance Manual: Upon completion and commissioning of system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer‟s operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner / Architect / Consultant and two for Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

21. On Site Training: Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labor and helpers for operating the entire installation for a period of fifteen (15) working days of ten (10) hours each, to enable the Owner‟s staff to get aquatinted with the operation of the system. During this period, the contractor shall train the Owner‟s personnel in the operation, adjustment and maintenance of all equipment installed.

22. Maintenance during Defects Liability Period

22.1 Complaints: The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

22.2 Repairs: All equipment that requires repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Owner.

23. Uptime Guarantee: The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance

shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of CD and bound printed comprehensive log book containing tables for daily record of all temperatures, pressures, humidity, and power consumption, starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner / Architect / Consultants review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

24. Partial Ordering: Owner through the Owner/Architect/Consultant reserves the right to order equipment and material from any and all alternates, and /or to order high side and / or low side equipment and materials or parts thereof from one or more tenderer.

25. Soft Water and Power Requirement: The contractor shall submit with their tender, their requirement of soft make-up water and power at each of their equipment / system wise / floor wise / section wise.

26 The following documents shall generally constitute the contract agreement:

a) Invitation to tenders.
b) Special conditions of contract, tender documents and drawings.
c) Complete correspondence with the successful bidder and owner shall be consolidated in one letter by the bidder.
d) Any other document necessary for completion of contract agreement.

27. Copy of the latest income tax clearance certificate must be submitted alongwith the offer.

28. Storage at site: Plant room/ AHU rooms, if available, can be used by the contractor for storage of equipments/ materials brought to site for execution of the work. However, watch and ward of the same shall be at contractor‟s risk.

DESIGN PARAMETRS

Given blow are some design parameters which should be followed in addition to those given in various sections of technical specifications enclosed

DUCTING WORK

a) Method of Duct Design	:	Equal friction method / constant friction method
b) Maximum Air Velocity in supply air duct	:	450.00
c) Maximum Air Velocity in return air duct	:	305.00
d) Friction loss in duct (max) MM wg in 100 Mt run	:	10
e) Maximum Velocity at supply air grill outlet MPM	:	150.00

INSULATION

Maximum temperature rise in the supply air duct from Air Handlers outlet to farthest outlet 1.1Deg C

APPLICABLE STANDARDS

AND CODES TERMS AND DEFINATIONS

The following terms have been used in the tender specifications and drawings etc.

ISI	Bureau of Indian standards
ASHRAE	American society of Heating Refrigeration and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
BS	British Standard
CMH	Cubic Meter per hour
USGPM	US gallons per Minute
RPM	Rotations per minute
BTU/Hr.	British Thermal unit per hour
Kcal/ Hr	Kilo calories per hour
SAG	Supply air Grill
RAG	Return Air Grill
FD	Fire damper
FAD	Fresh air damper
DP	Drain Point
SAD	Supply air diffuser
RAD	Return air Diffuser.

LIST OF BUREAU OF INDIAN STANDARDS CODES

Following relevant IS codes shall apply read in concurrence with there latest amendments.

IS:226-1975	Specification for structural steel
IS:277-1992	Specification for galvanised sheet (plain and corrugated)
IS:325-1978	Specification for three phase induction motors
IS:554 - 1975	Dimensions for pipe threads where pressure tight joints are required on the threads.

IS:655-1963 Specification for metal duct

IS 659-1964 (1991) Safety code for air-conditioning
(resived) IS:660-1963 (1991) Safety code for mechanical refrigeration

IS:778-1984 Specification for copper alloy and gate , globe & check valves for water works

IS:780-1984 Specification for sluice valves for water works (50 to 300 mm size) IS:800-1984 Code of practice for general construction in steel

IS:808-1964 Specification for rolled steel beam channel and angle section

IS:816-1969 Code of practice for metal arc welding for general purpose in mild steel IS:823-1964 Code of procedure for manual metal arc welding of mild steel

IS:1239-1979 (Part 1) MS tubes,tubulars and other wrought steel fittings

1990

IS:1239-(Part 2) -1992 MS tubes tubulars and other wrought steel fittings IS:1536 - 1976 Flanges configuration

IS:1554-(Part 1) -1976 Specs for PVC insulated (heavy duty electrical cables)

IS:2253-1974 Designation for types of construction and mounting arrangement of rotating electric machine.

IS:2312-1967 Specs for propeller type AC ventilating fans IS:2379 - 1963 Colour code for the identification of pipelines IS : 3103-1975 Code of practice for Industrial Ventilation

IS 4064 - (Part -II) 1978 Specific requirements for the direct switching of individual motors. IS: 4736 - 1968 Hot-dip zinc coatings on steel tubes

IS: 4894-1987 Test Code for Centrifugal Fan.

IS : 7240-1981 Application & Finishing of thermal insulation material IS:8544 (Part-I to IV)

1979 Starters

IS:9224 (Part II) - 1979 HRC cartridge fuse links upto 650 volts.

IS:3069-1965 Glossary of terms, symbols and unit relating to thermal insulation material IS:3346-1980 Method for the determination of thermal conductivity thermal I

insulation materal (two slab, guarded hot plate method) IS:3588-1966 Specification for electric axial flow fans

IS:3589-1981 and 1991 Seamless or electrically welded steel pipes for water, gas and sewage (168.3 to 2032 mm outside dia)

IS:3724-1966 Specs for cartridge type heating elements (non embedded type) IS:4158-1967 Specs for solid embedded type electric heating elements

IIS:4671-1984 Specs for expanded polystyrene for thermal insulation purpose

IS:4691-1984 Degree of protection provided by enclosure for rotating electrical machine IS:4722-1968 Specs for rotating electrical machine

IS:4729-1968 Measurement and evaluation of vibration of rotating electrical machine. IS:4831-1968: Recommendation on units and symbols for Refrigeration

IS:4894-1987 Specs for centrifugal fans

IS:5111 -1993 Testing of Refrigerating compressors.

IS:5512:(Part 1) -1984 Specs for swing check type (non return) for water works purposes. IS:6272-1971: Specs of industrial cooling fans

IS: 6392-1971 Specs for steel pipe flanges

IS:6168-1976 Code of practice for treatment of water for industrial cooling system

IS:7616-1975 Method of testing panel type air filters for air conditioning and ventilation purposes

IS;8623 1977 Specs of factory built switch / control section.

IS:8623(Part3) 1993: Specs for low voltage switchgear and control gear assemblies

IS: 8789- 1978 Values of performance characteristics for three phase induction motor

IS:9137-1978 Code for acceptable tests for centrifugal, mixed flow and axial pumps

Class C

IS:9338-1964 Specs for Cl screw down stop valves on stop and check valves for water works purpose

IS-13947 (Part-1)1993 Specs for low voltage switchgear and control gear.

In case of any revision in above BIS code the REVISED one shall only be applicable.

GENERAL MECHANICAL REQUIREMENTS

This chapter deals with the general mechanical requirements specifically applicable to HVAC. The additional requirement given in any chapter is in addition to the bare minimum stated in this chapter and shall be complied with.

1 SUBMITTALS

Under provisions of the NIT sample approval for all major items like grills, diffusers, valves, insulation, sheet etc is necessary before the commencement of the project. The products mentioned in the Approved list of manufacturers shall only be acceptable. In case of any alternate make is required to be used the same will have to be approved by the customer / engineer in charge with proper quality and rate justification as per the mode of approval mentioned in the list. Shop drawings and product data grouped to include complete submittals of related Systems, products, and accessories in a single submittal. Shop Drawings shall be based on the actual duct routes after the site survey, details of concrete pads and foundations for the various equipments, Layout of the AHU including dimensions of the room / boxing with inspection window dimensions, the foundations and the sizes and all necessary construction details required on site, location of the allied equipments and the requirements from other agencies, trench locations if any, Sump location and size, sleeve location if any, fresh air / exhaust air locations, location of wall mounted equipment (If any) and any structural inputs.

2 BROCHURES

Submit manufacturer‟s product data and brochure including complete description of the item with illustrations, rating charts, accessories, dimensional data, capacities stated in the terms specified in the NIT and Performance curves, wherever applicable like fans and pumps.

3 REGULATORY REQUIREMENTS

Liaison / Approvals from the bodies mentioned below (or any other), if required shall be taken by the contractor on behalf of the client and at his own cost. BIS / Local Fire Authority

/ LOCAL CODES.

4 PROJECT / SITE CONDITIONS

- Mechanical layouts indicated on drawings are diagrammatical. Co-ordination (final) shall be required with other trades prior to installation. Install all works as shown on the drawings, unless prevented by project conditions.
- Prepare drawings showing proposed rearrangement of work to meet the project conditions. Obtain permission from of engineer in charge before proceeding.
- Place anchors, sleeves and supports prior to pouring concrete on installation of masonry works.
- Keep roads and site clear of debris and scrap.

5 GENERAL INSTALLATION FEATURES

- Piping / ducting installation requirements are specified in other section. The Drawings indicate the general arrangement of piping, valves, fittings, ducts and specialties. The following are specific connection requirements:
- Arrange piping installations adjacent to units to allow unit servicing and maintenance.
- Connect piping to all equipment with flanges enabling easy removal of the coil.
- Connect condensate drain pans using drain pipe and extend to nearest floor drain. Construct deep trap connection to drain pan and install cleanouts at changes in direction.
- Make final duct connections with flexible connections.
- Connect unit components to ground in accordance with the National Electrical Code.

6 All shop drawing shall be prepared by the AC contractor after examining the architectural, interior and tender drawings. The tentative layout plans enclosed with the tender documents are only for guidance purposes only.

SPECIFICATIONS FOR PAINTING & IDENTIFICATION

1 Scope: The scope of this section comprises of identification of services for each piece of equipment

2 Identification of Services: Pipe work and duct work shall be identified by colour bands 150 mm. wide or colour triangles of at least 150 mm. / side. The bands of triangles shall be applied at termination points, junctions, entries and exits of plant rooms, walls and ducts, and control points to readily identify the service, but spacing shall not exceed 4.0 metres. Pipe work Services: For pipe work services and its insulation the colours of the bands shall comply with BS. 1710:1971. Basic colours for pipe line identification:

Pipe Line Contents	BS.4800 Colour Reference
Colour. Drainage	00 E
53	Black

Colour code indicator bands shall be applied as colour bands over the basic identification colour in the various combinations as listed below:-

Pipe Line Contents	Colour Bands as per BS. 4800

In addition to the colour bands specified above all pipe work shall be legibly marked with black or white letters to indicate the type of service and the direction of flow, identified as follows :-

Medium Temperature Hot Water	MTHW
Low Temperature Hot Water	LTHW
Chilled Water	CHW
Condenser Water	CONDW
Condensate	CN

Pipe shall have the letters F and R added to indicate flow and return respectively as well as directional arrows. Valve Labels and Charts: Each valve shall be provided with a label indicating the service being controlled, together with a reference number corresponding with that shown on the Valve Charts and " as fitted" drawings. The labels shall be made from 3 ply (black / white/ black) Traffolyte material showing white letters and figures on a black background. Labels to be tied to each valve with chromium plated linked chain. A wall mounted, glass covered plan to the approval of the Engineer in charge shall be provided and displayed in each plant room showing the plant layout with pipe work, valve diagram and valve schedule indicating size, service, duty, etc.

Duct Work Services: For Duct work services and its insulation the colours of the triangles shall comply with BS.1710: 1971. The size of the symbol will depend on the size of the duct band the viewing distance but the minimum size should not be less than 150 mm. length per side. One apex of the triangle shall point in the direction of airflow.

Services	Colour	BS.4800Colour Reference
Conditioned Air	Red and Blue	04 E 53 / 18 E 53
Fresh Air	Green	14 E 53
Exhaust / Extract / Recirculated Air	Grey	AA 0 09
Foul Air	Brown	06 C 39
Dual Duct System Hot Supply Air	Red	04 E 53
Cold Supply Air	Blue	18 E 53

In addition to the colour triangles specified above all duct work shall be legibly marked with black or white letters to indicate the type of service, identified as follows :-

Supply Air	S
Return Air	R
Fresh Air	F
Exhaust Air	E

The colour banding and triangles shall be manufactured from self adhesive cellulose tape, laminated with a layer of transparent ethyl cellulose tape.

SPECIFICATIONS FOR NOISE CONTROL

1 Scope: The scope of this section comprises of the supply, installation, testing and commissioning of noise and vibration control equipment and accessories.

2 General: Mechanical services shall generally be designed and installed with provisions to contain noise and the transmission of vibration, generated by moving plant and equipment at source where illustrated on the tender drawings and plant and equipment schedules to achieve acceptable noise rating specified for occupied areas. In addition to the provisions specified in the Specification, particular attention must be given to the following details at time of ordering plant and equipment and their installation :-

- All moving plant, machinery and apparatus shall be statically and dynamically balanced at manufacturers works and certificates issued.
- The isolation of moving plant, machinery and apparatus including lines equipment from the building structure.
- Where duct work and pipe work services pass through walls, floors and ceilings, or where supported shall be surrounded with a resilient acoustic absorbing material to prevent contact with the structure and minimise the outbreak of noise from plant rooms.
- The reduction of noise breakout from plant rooms and the selection of externally mounted equipment and plant to meet ambient noise level requirement of the Specifications.
- Electrical conduits and connections to all moving plant and equipment shall be carried out in flexible conduit and cables to prevent the transmission of vibration to the structure and nullify the provisions of anti-vibration mountings.
- All duct connections to fans shall incorporate flexible connections, except in cases where these are fitted integral within air handling units.
- Duct work connections to the fan inlets / outlets shall be concentricity aligned so that the flexible connections are not subjected to any strain and not used as a means of correcting bas misalignment.
- All resilient acoustic absorbing materials shall be non flammable, vermin and rot proof and shall not tend to break up or compress sufficiently to transmit vibration or noise from the equipment to the structure.
- Where practicable, silencers shall be built into walls and floors to prevent the flanking of noise the duct work systems and their penetrations sealed in the manner previously described.
- Where this is not feasible, the exposed surface of the duct work between the silencer and the wall subjected to noise infiltration shall be acoustically clad as specified.

INSPECTION AND TESTING PROCEDURES

7.1 All major equipment such as Air washing units, panels, fans shall be got inspected by the engineer in charge at works by the contractor. All routine tests shall be carried out and the test reports shall be submitted for approval before dispatch. The engineer in charge is free to witness any or all tests. In any case the OEM test certificates shall be submitted to the engineer in charge for verification of the same before the payments for the same can be processed. The contractor shall inform the engineer in charge well in time about the date of readiness of the equipment for inspection and testing. The inspection process shall be as under:

7.2 Electric Motor: The motor shall be of approved make. The OEM"s test certificates shall be furnished and verified with the name plate and serial no. The requirement shall be as per technical data submitted.

7.3 Ducting: The GI sheet to be used shall be physically checked for gauge as per IS 277. The bend test shall be performed at site. Randomly sample of each gauge shall be checked.

7.4 Insulation: All type of insulation material shall be physically checked for quality, thickness as per tender specification. The samples shall be checked for density at site. The same shall be correlated with the OEM test certificates. The material shall be having required thermal conductivity which will be verified from Test certificate.

7.5 Final Inspection: After completion of entire installation as per specifications in all respects, the contractor shall demonstrate trouble free operation of the entire installation simultaneously for a period of 48 hours spread over a period of 6 days continuous. The test readings shall be recorded in a mutually acceptable format. All tests shall be carried out by the contractor at his own expenses. However necessary utilities such as power and water shall be provided by the owner free of cost. The tests shall include but will not be limited to the following:

- To check satisfactory functioning of all equipment installed such as VRV units, panels, exhaust Blowers etc.
- Clean all equipment to remove foreign material and construction dirt and dust with Vacuum cleaner.
- Verify that the equipment is secure on mounting and supporting devices and that connection for piping, ductwork and electrical are complete.
- Verify proper thermal overload protection is installed in motors, starters, and disconnects.
- Perform cleaning and adjusting specified as per OEM.
- Check proper motor rotation direction and verify fan wheel / pump free rotation and smooth bearing operations.
- Reconnect drive system and align belts.
- Lubricate bearings, pulleys, belts, and other moving parts with factory recommended lubricants.

- Install temporary throw away filters for initial run and finally install clean filters.
- Verify manual and automatic volume control, and fire dampers in connected ductwork system are in the full-open position.
- Replace fan and motor pulleys as required to achieve design conditions.
- Measure and record motor electrical values for voltage and amperage.
- Flow measurements shall be by a calibrated rotating vane anemometer. Computed ratings shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current, whereas, noise level at various locations within the conditioned spaces shall be measured by a sound pressure level meter.

NOTE:

- All measuring instruments such as thermometer, Psychrometer, Pressure gauges, anemometers, dB Meter, Tong tester, etc or any other necessary instrument shall be arranged by the contractor at his own expense.
- The instruments shall be new and shall have a valid calibration certificate from a renowned test lab.
- The plant shall be run initially and all equipments shall be adjusted to give desired results as per contract. Thereafter the plant shall be test run for 48 hours as described above and the readings shall be demonstrated in the required format. The test shall be witnessed by the engineer in charge or his representative. In case the conditions are not achieved during the initial run test the plant shall be readjusted and the new dates for tests shall be determined. The entire test shall be repeated and satisfactory results shall have to be obtained. Only after satisfactory test the installation shall be taken over by the customer and warranty period for one year shall commence.
- The snag list prepared after initial test shall be attended to by the contractor during a maximum of 30 days from the start of warranty period. Failure to do so shall result in corresponding increase of warranty period.

SYSTEM DESIGN

1 General

The HVAC system for Academic Block 2 is for primarily Biology and Chemistry Labs. The AC system comprises of VRV system.

2 DESIGN CODITIONS

Outside Design

Temperature

	Dry Bulb Temperature	Wet bulb temperature
Summer	43.3^{O} C	23.8 ^{O}C
Monsoon	35^{O} C DB	28.3 ^{O} C WB
Winter	7.2 ^{O}C DB	5 ^{O} C WB

INSIDE CONDITIONS As per table attached

Hours of Operation	:	24 x 7 continuous
Roof Insulation	:	All exposed roof shall be insulated.
Exposed Glazing	:	All glass exposed to sun shall have suitable shading device
Occupancy	:	as per table attached
Equipment Load	:	as per table attached
Fresh Air	:	as per table attached
Filtration	:	HEPA filters for clean room. Few area have fine and prefilter only.

The VRV system based on the above considerations (only high side) shall be free issue to the site. The present scope of work shall be related to the lowside work which mainly ducting, Insulation, Electrical works, finishing works, and demonstration of inside conditions as stated above including clean room conditions.

SPECIFICATIONS FOR SHEET METAL WORKS

1. SCOPE

The scope of this section includes supply, fabrication, installation & testing of all sheet metal ducts as per specifications & drawings. Except as otherwise specified all ductwork and related items shall be in accordance with these specifications. Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners, hangers & all accessories.

2. DUCT MATERIALS

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII – Light coating of Zinc conforming to ISS: 277-1962 (REVISED) with accompanying Mill test Certificates. Galvanizing shall be of 120gms/sq.m. (total coating on both sides). In addition, if deemed necessary, samples of raw material, selected at random by owner"s site representative shall be subject to approval and tested for thickness and zinc coating at contractor"s expense.

Only new, fresh, clean (unsoiled) and bright GI / Aluminum sheets shall be used. The Owner / Consultants reserve the right to summarily reject the sheets not meeting these requirements. Fabrication of ducts shall be through Lock forming machines.

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

3 SPECIFICATIONS FOR SITE FABRICATED DUCING

All duct work, sheet metal fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with Amendment-I (1971 Edition)

Longer size of Duct	Sheet Thickness GI (MM)	Type of Joints	Bracing
Up to 750	0.63	GI Flange	-
751-1000	0.80	25x25x3 mm angle iron frame with 8 mm Dia nuts & bolts	25X25X3 MM @ 1M

1001-1500	0.80	40x40x5 mm angle iron frame with 8 mm Dia nuts & bolts	40x40x5 MM @1M
1501-2250	1.00	50x50x5 mm angle iron frame with 10 mm Dia nuts & bolts at 125 mm center	40x40x3mm@ 1.2m to be braced diagonally.
2251 & above	1.25	50x50x6 mm angle iron frame with 10 mm Dia nuts	40x40x3mm @ 1.6m diagonally braced

		& bolts at 125 mm center	

Ducts larger than 450 mm shall be cross broken, duct sections up to 1200 mm length may be used with bracing angles omitted.

Changes in section of ductwork shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 Deg. Angle from the axis of the main duct unless otherwise approved by the Customer / consultant.

All ducts shall be supported from the ceiling/slab by means of M.S. rods of 10 MM Dia with

M.S. angle at the bottom of size 40 mm x 40 mm x 6 mm for sizes up to 1500 mm at 3 m intervals. Above size 1500 mm upto 2250, support shall be provided with 10 mm dia. MS rod and MS angle size 50 mm x 50 mm at bottom at 2.5 m intervals. Above size 2250 mm support shall be provided with 12 mm dia MS rod and MS angle size 50 mm x 50 mm at bottom

3. INSTALLATION

All ducts shall be fabricated and installed in workman like manner, generally conforming to relevant BIS codes. Round exposed ducts shall be die formed for achieving perfect circle configuration

Ducts so identified on the drawing shall be acoustically lined and thermally insulated as described in the section „Insulation" and as indicated in „Schedule of Quantities. Duct dimensions shown in drawings are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in „Schedule of Quantities".

Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight.

All exposed ducts upto 60 cm width within conditioned spaces shall have slip joints. The internal ends of the slip joints shall be in the direction of airflow. Ducts and accessories within ceiling spaces visible from air-conditioned areas shall be provided with two coats of matt black finish paint.

Change in dimensions and shape of ducts shall be gradual. Air turns shall be installed in all vanes arranged to permit the air to make the turn without appreciable turbulence.

Ducts shall be fabricated as per details shown on drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees of ample size to keep the ducts true to shape and to prevent buckling, vibration or breaking.

All sheets metal connections, partitions and plenums required to confine the flow of air to/ through the filters and fans shall be constructed of 18 Gauge GSS thoroughly stiffened with 25mm x 25mm x 3mm angle iron braces and fitted with all necessary inspection doors as required to give access to all parts of the apparatus. Doors shall be not less than 45cm X 45cm in size.

Plenums shall be panel type and assembled at site. Fixing of MS angle iron flanges of duct pieces shall be with rivet heads inside i.e. Towards G.S. sheet and riveting shall be done from outside.

Rubber gasket 3 mm thick shall be used between duct flanges and between duct and duct supports instead of felt in all ducting installation for complete sealing.

During the construction, the Contractor shall temporarily close duct openings with sheet metal covers to prevent debris-entering ducts and to maintain opening straight and square, as per direction of Customer / consultant.

Great care should be taken to ensure that the ductwork does not extend outside and beyond height limits as noted on the drawings.

All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be tight and shall be made in the direction of airflow.

The ducts shall be reinforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All ducts shall be fabricated and installed in accordance with modern design practice. The sheet metal gauges and fabrication procedures as given in I.S. specifications shall be adhered to and shall be considered as an integral part of these specifications.

The ductwork shall be varied in shape and position to fit actual conditions at building. All changes shall be in accordance with accepted duct design and subject to the approval of the customer / consultant. The Contractor shall verify all measurements at building and shall notify the Customer / consultant of any difficulty in carrying out his work before fabrication.

Sponge rubber or approved equal gaskets shall be installed between all connections of sheet metal ducts to walls. Sheet metal connections shall be made to walls and floors by means of galvanized steel angles anchored to the building structure with anchor bolts and with the sheet bolted to the angles. Sheet metal connections shall be as shown in the drawings or as directed by Customer / consultant.

All ductwork shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angel/channel under ducts. All vertical ductwork shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles / channels shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash /

anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats.

Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality thermo Cole around the duct prior to sealing of the opening.

All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 100 mm long but not more than 200 mm, securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting ductwork rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.

Flanges and supports are to be black, mild steel and are to be primer coated on all surfaces before erection and painted with aluminum thereafter. Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

The ductwork should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling Contractors.

SPECIFICATIONS FOR AIR TERMINALS

1 SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of air terminals and dampers conforming to these specifications and in accordance with the requirement of drawings and „Schedule of Quantities".

2. TYPE

The terminals shall be of type as indicated in drawings and „Schedule of Quantities"

3. DAMPERS

At the junction of each branch duct with main duct and split of main duct, volume control dampers must be provided. Dampers shall be rigid in construction to the passage of air.

The volume dampers shall be of an approved type, lever operated and complete with suitable level links & quadrants, locking devices, which will permit the dampers to be adjusted and locked in any position.

The dampers shall be of opposed blade or louver type. The damper blade shall not be less than 1.25 mm (18) gauge and shall not be over 225 mm wide. Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Damper frames shall be constructed of 16 gauge steel

After completion of the ductwork, dampers are to be adjusted and set to deliver the required amount of air as specified in the drawings.

4 ACCESS PANEL

A hinged and gasket access panel shall be provided on ductwork before each control device that may be located inside the ductwork. Doors shall be provided with neoprene rubber gaskets. Angle joints shall be provided with neoprene rubber gaskets for leak tightness of the joints. Access door/panels shall be provided: -

- Near each smoke sensor

- Any other place specifically mentioned in the drawing or if asked by Owner / Consultants during execution stage.

5. LINEAR GRILLS:

Linear continuous supply or return air grills shall be extruded aluminum construction with fixed horizontal bars at 0 / 15 ^{0} inclination with flanges on both sides. The thickness of fixed bar louvers shall be 3mm in front and the flange shall be 20mm wide with round edges. The grille shall be suitable for concealed fixing and horizontal bars of the grille shall be mechanically crimped from the back to hold them. Volume control device of GSS construction in black mat finish shall be provided in S.A. duct collars.

6. SUPPLY / RETURN AIR GRILLS WITH HORIZONTAL / VERTICAL OR VERTICAL / HORIZONTAL LOUVER ARRANGEMENT:

The grille shall be adjustable as each louver shall be pivoted to provide pattern with 00 to plus or minus 150 ARC upto 300 deflection down towards. The louvers shall hold deflection settings under all conditions of velocity and pressure. The rear louver of the register shall be in black shade.

Volume control device of GSS construction with black mat finish shall be provided in S.A. grills.

7. EXHAUST AIR REGISTER:

Exhaust air register shall be made of extruded aluminum with fixed horizontal louvers at 40 degree angle setting on a 20 mm louvers pitch. The register shall have 20 mm wide flange with round edges all around. The register shall be suitable for front screw fixing.

Volume control device of GSS construction with black mat finish shall be provided.

8. MISCELLANEOUS

Sponge rubber gaskets also to be provided behind the flange of all grills. Each shoot from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot. Inspection doors measuring at least 450 mm x 450 mm are to be provided in each system at an appropriate location, as directed by Customer / consultant.

Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck. Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by Customer / consultant. All duct work joints are to be true right angle and with all sharp edges removed.

9 PAINTING

All grilles, and diffusers shall be powder coated in color as approved by Architect / Consultant before installation.

All ducts immediately behind the grilles / diffusers etc are to be given two coats of black paint in Matt finish. The return air and dummy portion of all linear grilles shall be provided with a vision barrier made of 24 gauge galvanised sheets. The vision barrier shall be fixed to the false ceiling frame with self tapping screws and shall be given two coats of black paint in matt finish. Care shall be taken to ensure that the return air path is not obstructed.

SPECIFICATIONS FOR INSULATION

1 SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of air terminals and dampers conforming to these specifications and in accordance with the requirement of drawings and „Schedule of Quantities".

2 MATERIAL

Insulation material for **Duct insulation** shall be Closed Cell Elastomeric Nitrile Rubber. Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.038 W/m°K or 0.313 Kcal/M hr°C or 0.212 BTU/(Hr-ft^2-° F/inch) at an average temperature of 30° C. The product shall have temperature range of -40° C to 105° C. Density of material shall not be less than

0.06 gm/cm^3. The insulation shall have fire performance such that it passes minimum CLASS O as per BS476 part 7 for surface spread of flame. Water vapour permeability shall not exceed 0.024 per inch (3 x 10 $^{-14}$ Kgs/m.sec.Pa). The material shall have approval from the Chief Fire Officer.

Insulation material for **Duct Acoustic Lining** shall be resin bonded fibre glass. The thermal conductivity shall not exceed 0.034K Cal/(hr-sq.m-deg C/meter) or 0.23 BTU/(hr.sq.ft.-deg F)/inch) at 32 deg C (90 deg F) mean temperature and density shall be not less than 32 Kg/Cum. Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values and density. Samples of insulation material from each lot delivered at site may be selected by Engineer in charge and gotten tested for thermal conductivity and density at Contractor‟s cost All joints shall be sealed properly with adhesive, which shall provide similar vapour barrier as the original insulating material.

3 APPLICATION

3.1 Duct acoustic Lining: Thickness of the material shall be as specified for the individual application. Ducts so identified and marked on drawings and included in Schedule of Quantities shall be provided with acoustic lining of thermal insulation material for a distance of minimum 5 meters as follows:

The inside surface for the ducts shall be cleaned, and provided with 22 gauge GI Channels 25 x 25 mm screwed back to back and fixed on the inside of duct, spaced not more than 60 cm center to form a frame work of 60 x 60 cms square. Cut panels 60 x 60 cms of fiber 25 mm thick shall be fitted in the squares. The insulation panels shall be fired to the sheet metal with cold setting adhesive compound and covered with fibre glass tissue paper.

The inner most surfaces shall be covered with 28 gage perforated aluminium sheet having atleast 15 percent perforations. The aluminium sheet shall be screwed to GI channels using cup washer and neatly finished to give true inside surface.

3.2 Duct Insulation: External thermal insulation (indoor application) shall be provided as follows: The thickness of closed cell shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

- Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubber sheets to size with sufficient allowance in dimension.
- Material shall be fitted under compression and no stretching of material shall be permitted.
- A thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond.
- All longitudinal and transverse joints shall be sealed with adhesive SR 998 or equivalent.
- 26 G GI Chicken wire mesh shall than be wrapped on the insulated duct to hold the insulation.

For Outdoor application (exposed to sunlight) in addition to the insulation as specified above the exposed duct shall be covered with 2 layers of TAC cloth dipped in UV protection paint as specified by OEM. This procedure has to be applied as per written confirmation from OEM. The final installation has to be certified for correctness by the OEM.

3.3. FIRE BREAKS INSULATION

Firebreaks shall be provided in all ducts for internal lining/external thermal insulation after a run of 10 m center to center. There shall be a discontinuity of the insulating material in the form of MS angle of a minimum of 50 mm x 50 mm x 3 mm size. At the interface of the MS angle and insulating material, proper care of tucking in of the insulating material shall be taken so as to prevent erosion.

SPECIFICATIONS FOR PIPING

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

2. Piping:

2.1 Drain Piping: PPRC Pipes

2.1.1 The drain piping shall be PN16 grade PPRC and laid in continuous slope.

2.1.2 The fittings shall be of PN25 grade of equal forged connections.

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

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

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

3. Pipe Insulation :

a. Drain Pipe Insulation

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

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

SPECIFICATIONS FOR ELECTRICAL WORK AND CABLING

1. Scope: The scope of this section comprises of the supply, erection testing and commissioning of electrical switchgear and wiring installation.

2. General: Work shall be carried out in accordance with the specifications, local rules, IE Act 1910 as amended up to date and rules issued there under, regulations of the local fire insurance association and Indian Standards Code of Practice No. IS: 732-1963 or relevant BSS and CPWD General Specifications for Electrical work (Internal)-1977. For items of work not covered by any of the above regulations, wiring rules in the 13th Edition of the Institution of Electrical Engineer, London, shall apply. Definition of terms shall be as in the IEE Rules.

3 MOTORS

3.1 General: These specifications cover all types of motors used. The motor installation, wiring control shall be carried out strictly in accordance with the specification here-in-after laid down.

3.2. Rating: The ratings of the motors shall be minimum as indicated in schedule of equipment and schedule of quantities. The rating shall be on the basis of ambient temperature and allowable maximum temperature rise as specified.

Standards: All motors shall comply with IS: 325 in respect of general requirements and performance. Motors shall also conform to IS: 1231 or relevant BSS, IEC 72.1 for foot mounted motors and IS: 2223 or relevant BSS and IEC 72.2 for flange-mounted motors.

In general, all the motors above 1 hp. shall be 3 phase unless otherwise specified, motors of 1 hp of or below shall be either 3 phase or single phase as required.

Motors shall run at all loads without appreciable noise or hum. Motors shall be one of the following design as specified:

- Squirrel cage
- Totally enclosed
- Totally enclosed, fan cooled.

Windings of motors shall be Class 'B' insulated and fully tropicalised. The insulating materials used shall not be liable for action of fungi or microbes. The insulation shall afford adequate protection against chemically aggressive gases and vapour as well as against conductive dust.

Motors shall be rated for continuous duty as defined in IS 325 or relevant BSS. All motors shall have suitable torque characteristics as required by the duty of driven equipment. Motors shall be suitable for operation on 415 volts, 3 phase, 50 HZ, AC supply.

Motors shall be provided with a combination of ball and roller bearing. The roller bearing shall be fitted at the driving end and the ball bearing shall be fitted at the free end and shall have ample capacity to deal with ray axial thrust. The bearing shall be of standard cartridge type which effectively seals of dust and moisture. Suitable grease nipple shall be provided for re-greasing the bearing.

Motors shall be provided with a cable box to suit aluminium conductor, PVC insulated, PVC sheathed and steel armored cable.

Motors shall be so designed to operate successfully under the following conditions of voltage and frequency variation.

- Where the voltage variation does not exceed 10% above or below normal
- Where the frequency variation does not exceed 5% above or below normal
- Where the sum of the voltage and frequency variation does not exceed 10% (provide the frequency variation does not exceed 5%) above or below normal.

Motors, except fractional horse power motors of 1/8 hp. and below shall be provided with running over current protection, generally by means of a bimetallic thermal over load protective device incorporated in the starter panel. Motors starting current shall not exceed 600% of full load current

The starting current of the motors shall be limited by using the following starters, as required.

Type of Motors

a)	Squirrel cage motors upto 7.5 HP	:	Direct on line starters
b)	Squirrel cage motors of of 10 HP and above	:	Automatic Star/Delta starters.

3.3 Motor Starters

Motor starters shall be manufactured in accordance with IS:1882 or BS:587. The starters shall be totally enclosed, metal clad, dust and vermin proof construction. Unless otherwise specified, all starters shall be direct on lines, automatic star / delta, auto-transformer startor- rotor pattern as required. All starters shall be continuously rated and shall be of automatic contactor type. All starters shall be suitable for 415 volts, 3 phase, 50 HZ. AC supply.

Contactors shall be of the number and poles as required for appropriate duty. The making and breaking capacity of the contactor shall be as per category A-4 conforming to BS: 775. All the contacts shall be solid silver or silver faced and all the contactors and starter equipment shall be designed for not less than 40 operations per hour. Means shall be inherent in the starter for automatically disconnecting the starter from electricity supply in the event of interruption of supply, however, the contactor, and/or associated under voltage relays shall be suitable for voltage not lower than 25% below the normal supply voltage. Unless otherwise specified, all starters shall have integral 'Start / Stop' push buttons. Start push buttons shall be coloured green and shall be shrouded to prevent inadvertent operation. Stop push buttons shall have mushroom heads and coloured red. All push buttons operated contactors shall be provided with a maintenance/running contact. All remote control circuit taken from the starter shall operate at 230 volts or lower voltage.

Motor starters shall be provided with thermal over load relay with adjustable settings, on each phase for three phase motor. The motors of 10 hp. and above shall be provided with current transformer operated thermal over load relays. The thermal overload relays shall have thermal characteristics suitable for the associated motor, its starting characteristics and suitable compensated for ambient air temperature variations. Single phase preventors shall be provided for all the three phase motors. Green, Red, amber indicating lamps shall be installed on each starter to indicate open and close conditions of the contactors and fault conditions of motor as detected by the thermal overload relay.

Thermal blocks with integral insulating barriers shall be provided for each starter. All the starters shall be provided with a schematic diagram on a durable material fixed permanently within each lid or cover. Starters shall be provided with sufficient extra N/O and N/C contacts for interlocks, indicating lamps etc. Automatic Star/Delta starters shall be provided with adjustable timers.

3.4 Installation of Motors: Motors shall be mounted on a common foundation with the driven machine or equipment coupled through a flexible coupling or through belt drive. The drive arrangement shall be provided with a safety guard. Motors shall generally be provided with slide rails fixed to the base with nuts and bolts to facilitate belt installation and subsequent belt tensioning. Motors shall wired as per the detailed specifications and drawings. Motors shall be tested in accordance with the relevant Indian Standard / British Standard

specifications and test certificates shall be furnished in triplicate. Motors shall be tested at site after erection for insulation resistance. All the motors, starters and frames shall be painted with two coats of synthetic enamel paint.

4 MOTOR CONTROL CENTRE

4.1 General: Motor control centre shall be provided and installed wherever specified for controlling motors. Motor control centre shall comprise of circuit breakers, switch fuses, starters, control and indicating equipment as specified. The motor control centre shall be totally enclosed metal clad, flush front and back, cubicle pattern suitable for front and rear access. The motor control centre shall conform to NEMA Class-I or Class-II as required.

The MCC shall be constructed of high quality heavy gauge sheet steel stiffened and reinforced by a sturdy angle iron frame work. The steel sheets shall be taken to ensure that it is termite and vermin proof. The housing shall be sectionalized construction. All portions should be used for accommodating accessories as detailed above, according to the size of the equipment to be accommodated.

The bus bars and connections shall consist of hard drawn high conductivity aluminium strip with PVC sleeves of appropriate phase colour. The bus bars shall be mounted edgewise on insulated bases which will permit sufficient movement for compensation of temperature stresses and also to withstand the electro-magnetic forces produced during short-circuits. The neutral bus bar shall be rated for 60% of the phase rating.

The panel shall be powder coated battleship grey or any other approved colour. Name plates to indicate the equipment controlled through individuals switch fuse unit shall be fixed on the panels.

4.2 Construction: Motor control centers shall be free standing type/wall mounted type with basic structure being fabricated out of 12 gauge / 14 gauge steel with reinforcing channels welded in place. All the doors shall be of 14 gauge steel. The enclosure of motor control centers shall be rigid and strong. The motor control centers shall have a bus bar chamber at the top or bottom and feeder compartments of modular dimensions in vertical section. Vertical bus bars connected to the main bus bars shall be located behind each vertical feeder compartment.

Individual compartments shall be of adjustable type and shall be of convertible design such that rating of feeder control units can be changed if required. Breaker and switch handles and starter push button shall be mounted on the devices and on the doors. Suitable screw and rawl device shall be provided on each compartment door for locking the doors in position. On the right hand side of each vertical feeder/control compartment, a vertical wire way cable

shall be provided. Cable Alley wire ways shall be provided with separate doors. Cable doors shall be of bolted type or otherwise as specified.

4.3 Bus bars: All bus bars shall be suitable for 415 volts, 3 phase, 4 wire, 50 HZ, AC supply. Main and vertical bus bars shall be made of high conductivity aluminium. The thermal short circuit capacity of horizontal bars shall not be less than 45 KA rms, and that of vertical bus shall not be less than 37 KA rms. Bus bars shall be supported and braced at regular intervals on suitable insulating material such as hylam or permali. All the bus bars shall be adequately shrouded and isolated from unit compartments and wire ways. Special care shall be taken in the design of bus bars with regard to the safety aspects. Horizontal bus bars and horizontal wire ways shall be separated by non-metallic barrier (preferably fiber glass polyester of hylam). The vertical bus bars shall be isolated from unit/feeder/control compartments with non metallic barriers.

4.4 Earthing: Entire motor control centre shall be provided with copper earth bus running throughout the length of the panel. In addition, a vertical earth bus shall also be provided in each vertical section to facilitate earthing of various feeder/Control compartment trolleys. Feeder compartment trolleys shall be provided with earth pin which make first and brakes after the main plug in contacts. Motor control centers shall be provided with 2 Nos. earthing bolts for connections to the local earth grid.

4.5. Unit Compartments: Each compartment in a vertical section shall be provided with screw arrangement for jacking of the feeder trolleys. The trolleys shall be available in various modular dimensions. The movement of the feeder trolley shall be controlled by only the screw jacking arrangement. The feeder / control equipment shall be mounted on the vertical wall of the trolley and all the components of feeder / control equipment shall be easily accessible from the front. Plug in copper contacts of the trolley shall be provided with a locking arrangement such that the movement of the trolley can be prevented in both fully 'Plugged-in' and 'Isolated' position. It shall be possible to clamp the trolleys to the motor control centre structure when in fully plugged-in' position by a screw. All the equipment mounted in the compartment trolleys shall be marked with proper designation as per the drawings.

Each feeder / control unit compartment shall be provided with an independent door. Unit doors shall be fastened to the stationary structure by a removable hinge. Unit doors shall be held closed by a slotted, knurled quarter fastener. Suitable padlocking arrangement shall also be provided. All units doors shall be provided with rubber gaskets.

4.6. Interlocking arrangements: Motor control centers shall be provided with the following safety interlocks.

a) All the switches / breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. This interlock shall also prevent opening the unit door unless the switch/breaker is in 'off'position.

b) All the switches/breakers handles can be locked in 'ON/OFF' position.

c) An integral operating handle shall be provided for each switch/breaker. The position of the breaker/switch shall be indicated by the operating handles.

4.7. Wiring: Control and auxiliary wiring shall be carried out with copper conductor, PVC insulated wires. Wiring shall be properly colour coded and laid out neatly in bunches and firmly fastened to the sides in the trolley. The terminations for conductors shall be done by crimping lugs on to the conductor ends. Suitable printed PVC ferrules shall be provided for easy, identification of wires. Power wiring from the unit switches / circuit breakers to the starters shall be carried out using Aluminium armoured conductor PVC insulated wires of adequate current ratings suitable for the equipment. The wiring shall be colour coded using red, yellow, blue and black for 3 phase and neutral respectively. All terminations shall be carried out by crimping lugs on to the conductor ends. The lugs shall be fastened to the equipment using suitable washes and screws. All the wiring shall be neatly bunched and fastened to the sides of the trolley. Wiring selection for power shall be done considering the effects of temperature rise, bunching. All conductors shall be provided with printed PVC ferrules for easy identification.

4.8. Terminals Suitable fixed or plug and socket type terminals shall be provided for each compartment of MCC for terminating the power cables. The terminals shall be of adequate rating to suit aluminium conductor, PVC insulated, PVC sheathed armored cables. All the terminations shall be suitably numbered as per the wiring diagram.

4.9 Enclosure and Surface Treatment Motor control centre shall be of dust and vermin proof construction suitable for indoor installation. Enclosure shall have degree of protection IP–54 as per IS: 2147 or relevant BSS. All doors shall have rubber gaskets. Adequate protection shall be provided so that ingress of dust and vermin moisture encountered in indoor installations shall not in any amount be sufficient to interfere with the satisfactory operation of the enclosed equipment. Sheet metal components and accessories of motor control centers shall be given a rigorous antirust treatment comprising of degreasing, hot dip phosphating before the primer paint is applied. The sheet metal shall then be stove enameled with enamel paint to the approved finish. The interior of the motor control centers shall be painted to an off white shade.

4.10 Name Plate Motor control centers as well as their individual compartments shall be provided plastic or black anodised screwed name plates.

4.11 Diagram: Each compartment of MCC shall be provided with a circuit diagram of its components and wiring and fixed on to the inner surface of door or lid.

4.12 Painting All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivaiting (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per relevant BIS code.

4.13 Labels: Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel door and covered with transparent plastic sheet.

4.14 Drawings: Shop drawings for control panels and for wiring of equipment showing the route of conduit & cable shall be submitted by the contractor for approval of Engineer in charge before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

5 SWITCHGEAR

5.1 General: All material shall be of the best quality complying with the appropriate IS / BS specification and shall conform to the list of makes given in the tender. Materials used shall be subjected to the approval of engineer in charge and samples of the same shall be furnished where required. All switchgear shall be suitable for a system short circuit capacity of 35 MVA at 415 volts. The isolators / HRC switch fuse units shall be of the heavy duty pattern with a quick make and break down. The isolators/HRC switch fuse units shall be able to carry rated current continuously without excessive temperature rise or softening of welding of contacts. Provision shall be made for the incoming and outgoing conduits or cable entries as required.

5.2 MOULDED CASE CIRCUIT BREAKER (MCCB) All MCCB"s shall be motor duty and Current Limiting type and comprise of preferably Double Break Contact system, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCB"s shall be capable of defined Variable overload adjustment. All MCCB"s rated 200 Amps and above shall have adjustable Magnetic short circuit pick up. The trip command shall override all other commands. The breaking capacity of MCCB"s shall be asked for in the schedule of quantities. The breaking capacities specified will be ICU=ICS i.e type-2 Co-ordination as per relevant BIS and IEC Codes. The MCCB"s shall be provided with rotary handle operating mechanism. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

5.3 Miniature Circuit Breaker (MCB)_Miniature Circuit Breaker shall comply with relevant BIS Codes and shall be quick make and break type for 230/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

5.4 Current Transformers: Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering. The CTs shall confirm to relevant Indian Standards. The design and construction shall be dry

type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

5.5 Selector Switch: Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

5.6 Starters: Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta shall be fully automatic.

5.7 Contactor: Contactor shall be built into a high strength thermoplastic body and shall be provided with an arc shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter. Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of
0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta and Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E". Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 220/415±10% volts AC, 50 cycles AC supply.

5.8 Thermal Overload Relay: Thermal over load relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing as well as on overloading. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions. Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual-reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5° C to +55° C. All overload relays shall be of three element, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

5.9 Time Delay Relays: Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

5.10 Indicating Lamp and Metering: All meters and indicating lamps shall be in accordance with BS 37 and BS39. The meters shall be flush mounted type. The indicating lamp shall be of low wattage. Each MCC and control panel shall be provided with voltmeter 0–500 volts with three way and off selector switch, CT operated ammeter of suitable range with three nos. CTS of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 amps fuse. Other indicating lamps shall be backed up with fuses as called for in Schedule of Quantities.

5.11 Toggle Switch: Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS Codes and shall be of 5 amps rating.

5.12 Push Button Stations: Push button stations shall be provided for manual starting and stopping of motors / equipment Green and Red colour push buttons shall be provided for „Starting" and „Stopping" operations. „Start" or „Stop" indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for „Stop" push buttons. The push button contacts shall be suitable for 6 amps current capacity.

6 ELECTRICAL CABLING AND WIRING

6.1 Wiring shall be carried out with PVC insulated, PVC sheathed and armored cables. Wiring shall be suitable for a 3 phase, 50 Cycles, 4 wire supply with 415 volts between phases and 230 volts between phase and neutral. The voltage and frequency of supply shall be subjected to variations permissible under the Indian Electricity Act and Rules.

6.2 Cable Laying Cable shall be laid generally in accordance with Indian Standard Code of Practice. Cables shall be laid in trenches or buried or carried on walls as stated in the schedule, indicated on the drawings. Where more than one cable is running, proper spacing shall be provided to minimise the loss in current carrying capacity. Cable racks and trays shall be provided wherever specified. Cables shall be suitably supported with angle iron clamps mounted on MS supports when run on walls. The distance between supports shall not be more than 0.5 Meter. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bends of the cable when installed shall be sufficiently large to ensure that no undue stress is caused on the insulation / conductor. Where cables pass through pipes, wooden / PVC bushes shall be provided at the ends. When these pass through floors or walls the cable holes shall be sealed in a manner approved by Owner.

6.3. Equipment Wiring Final connections to the equipment shall be through flexible wiring particularly for equipment mounted on guide rails and which are liable to be moved.

6.4 Earthing shall be as per IS: 3043 – 1963 in all respects. The earth station shall consist of GI pipe and accessories as per IS: 3043. The connection between earth plate and main earth bar shall be by means of 3 Nos. 3/8″ brass bolts and nuts. These bolts shall be fixed atleast 4″ apart. The earthing station shall be preferably located in a grassy lawn/near flower beds / near water taps. These shall be kept atleast 2 meter away from the foundation of the building or outer face of the building. The distance between earth stations shall be atleast 5 meters. No earth electrode shall have greater ohmic resistance than 0.5 ohms as measured with approved earth testing equipment. In case of rocky soil, it may be relaxed to 0.8 ohms.

All switches/isolators shall be connected to the earth and size of earth conductor shall be depending upon the size of the cable connected with the switch / isolator:

Cross sectional area of current carrying conductor (SWG)		size of earth copper conductor
1.		4/ 6/10 8
2.	16/25/35	6
3.	50/70/95	4
4.	120/150/185/225/240	25x3mm strip
5.	300/400	40x5mm strip

6.5 Control/Indication/Interlocking wiring The control/indication/interlocking wiring shall be done with 1.5 sq.mm PVC insulated and PVC sheathed copper conductor cables of 2/3/4/6 cores as per requirement. All the machines as detailed in the drawing shall be remote controlled at the main panel board through push buttons (ON/OFF Buttons). All the machines shall have red/green lamp indicators to shown the working/off position of individual machined. An electrical interlocking shall be provided for safe running of refrigeration machines i.e. the refrigeration machine shall only start after CT fans, condenser water pumps, chiller water pumps have started working. Control wiring for individual fan coil units shall be done with 2.5 sq.mm copper conductor single core cables drawn in recessed conduit.

6.6 Conduits: Conduits and Accessories shall conform to relevant Indian Standards. Wall thickness shall be 16 gauge upto 32 mm dia and 14 gauge above 32 mm dia conduit. Screwed
G.I. conduits shall be used. Joints between conduits and accessories shall be securely made, to ensure earth continuity. All conduit accessories shall be threaded type only. All raw metal shall be painted with bitumastic paint. Only approved make of conduits and accessories shall be used. Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

The minimum size of control wiring shall be 1.5 sq. mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels. Power cabling shall be of the following sizes:

Horse power of motor	Size of conductor
Upto 5 HP motors	3 x 4 sq. mm.
(copper) From 6 HP to 10 HP motors (copper)	3 x 6 sq. mm
From 12.5 HP to 15 HP motors	2 Nos. 3 x 6 sq. mm (copper)
From 20 HP to 25 HP motors	2 Nos. 3 x 10 sq. mm (copper)

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The capacity contactors and overload relays shall be provided for different capacity motors as per manufacturer‟s recommendation.

Two speed motors when specified, shall be provided with DOL starter irrespective of it rating.

7 Completion Drawings: Four sets of completion drawings giving single line diagram run of cables location along with detail wiring panels, indication/interlocking circuits cable with sizes with in the building/under ground cables showing the location of straight through joint boxes, location of main earthing stations shall be furnished within one month from the date of completion of the work.

8. Testing: Before the commissioning of the plant, the entire installation shall be tested in accordance with Guide of practice IS: 732-1963 or relevant BSS and the test report furnished by the qualified and authorized person. The electrical installation shall be got passed from local Electrical Inspector. All tests shall be carried out in the presence of Engineer in charge.

9 Rubber Mat: Rubber mat shall be provided in front to cover the full length of all panels. Where back space is provided for working from the rear of the panel, rubber mat shall also be provided to cover the full length of panel.

PREAMBLE TO MODE OF MEASUREMENT

1 All equipment described hereafter shall be in accordance with the specifications. All equipment shall be selected and installed for the lowest Operating noise level.

2 Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Consulting Engineer, procurement of equipment, transportation, shipping, payment of all

taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components, and warranty obligations for the individual equipment.

3 Installation of various equipment shall include all material and labour associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting and anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.

4 Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.

5. Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.

6. Testing and commissioning shall include furnishing all labour, materials, equipments, instruments,and incidentals necessary for complete testing of each component as per the specifications and manufacturer's recommendations, submission of test results to the Consulting Engineer and obtaining their approval and submission of necessary documents and completion drawings.

7 All ducts shall be fabricated and installed conforming to the relevant Indian standards, approved shop drawings and the specifications.

8. Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, and distribution grids within the ducts in position, and providing, installing and making air tight all joints with slips, bonded felt insertions, nuts, bolts and screws as required.In addition multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flows.

9 All registers and diffusers shall be provided with a soft continuous rubber gasket between their periphery and the surface on which these have to be mounted.

10 Registers and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved colour.

11 After completion of the installation, the entire air distribution system shall be tested for air leaks and balanced in accordance with the specifications.

MODE OF MEASUREMENT

1 Measurement of Equipment:

- Electrical Panel: Panels shall be counted as number of units. Quoted rates shall include as lumpsum for all internal wiring, earthing connections within panel box. The quoted rate of panel shall also include all accessories, switchgear, contactors, indicating meters and lights as per the Specifications and Schedule of Quantities.

2 Measurements for Ducting: All ducts fabricated and installed should be accompanied and supported by proper documentation. Bill of material / Packing list for every duct section supplied. Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise. Each and every duct piece to have a tag 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 and verification. Unless otherwise specified, measurements for ducting for the project shall be on the basis of centerline measurements described herewith. Ductwork shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the center of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in a similar manner. For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centerline distance between the flanges of the duct section. For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centerline. The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 5mm thick between duct and support, vibration isolator suspension where specified or required. The following accessories will be part of ducting and shall NOT be separately measured nor paid for

- inspection chamber / access panel,
- splitter damper with quadrant and lever for position indication,
- turning vanes,
- straightening vanes
- all other accessories required to complete the duct installation as per the specifications.

3 Air Distribution accessories shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

- Grilles and registers – width multiplied by height, excluding flanges.
- Volume control dampers – width multiplied by height, excluding flanges
- Diffusers – cross section area for air flow at discharge area, excluding flanges.
- Fire dampers – shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.
- Flexible connection – shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.
- Motorised Volume control damper – width multiplied by height, excluding flanges.
- Exhaust air / Fresh air Louvers – shall be measured by their cross sectional area perpendicular to the direction of air flow.

4 Measurement of Duct Insulation: Unless otherwise specified measurement for duct insulation for the project shall be on the basis of centre line measurements described herewith Duct Insulation shall be measured on the basis of surface area along the centre line of insulation thickness. Thus the surface area of externally thermally insulated or acoustically lined be based on the perimeter comprising centre line (of thickness of insulation)width and depth of the cross section of insulated or lined duct, multiplied by the centre-line length including tapered pieces, bends, tees, branches, etc. as measured for bare ducting.

5 Measurement For Piping: Unless specified otherwise, measurement for piping for the project shall be on the basis of centre line measurements described herewith Piping shall be measured in units of length along the centre line of installed pipes including all pipe fittings, flanges (with gaskets, nuts, and bolts for jointing), unions, bends, elbows, tees, concentric and / or eccentric reducers, inspection pieces, expansion loops etc. The above accessories shall be measured as part of piping length along the centre line of installed pipes, and no special multiples of pipe lengths for accessories shall be permitted. The quoted rates for centre line linear measurements of piping shall include all wastage allowances, pipe supports including hangers, MS channel, PUF supports, nuts, check nuts, vibration isolator suspension where specified or required, and any other item required to complete the piping installation as per the Specifications. None of these items will be separately measured nor paid for. However, all valves (gate / globe / check / balancing / purge / butterfly / drain etc), strainers, thermometers, pressure gages shall be separately counted and paid as per their individual unit rates, which shall also include

their insulation as per Specifications. Piping measurements shall be taken before application of the insulation. Contractor shall get pressure testing of pipes / measurements etc verified by the representative of Engineer in charge at site.

6 Measurement of Pipe Insulation: Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements described earlier. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers are separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding, valves, orifice plates and strainers shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

7 Measurement of cabling: All power cabling, control cabling and earthing the same shall be measured for actual length and paid as per the unit rates available in the tender quotes.

INSPECTION AND TESTING PROCEDURES

The AC contractor shall inform the engineer in charge well in time about the date of readiness of the equipment for inspection and testing. The inspection process shall be as under:

Equipment like VRV/VRF units, Ductable units, fans, Indoor units

- The manufacturer‟s test certificate shall be furnished and verified.
- The test certificates shall be correlated with the equipment serial no.

Electric Motor

- The motor shall be of approved make. The OEM‟s test certificates shall be furnished and verified with the name plate and serial no. The requirement shall be as per technical dat submitted.

Pipes

- Make, wall thickness for the pipe shall be checked at random for 5% of pipe lengths and shall be correlated with relevant IS codes.

Ducting

- The GI sheet to be used shall be physically checked for gauge as per IS 277. The bend test shall be performed at site. Randomly one sample of each gauge shall be checked chemically for composition and galvanizing by a reputed lab and report shall be submitted before starting work at site.

Insulation

- All type of insulation material shall be physically checked for quality, thickness as per tender specification.
- The samples shall be checked for density at site. The same shall be correlated with the OEM test certificates.
- The material shall be having required thermal conductivity which will be verified from TC.

Final Inspection

After completion of entire installation as per specifications in all respects, the AC contractor shall demonstrate trouble free operation of the entire installation simultaneously. The test readings shall be recorded in a mutually acceptable format. All tests shall be carried out by the AC contractor at his own expenses. However necessary utilities such as power and water shall be provided by the owner free of cost. The tests shall include but will not be limited to the following:

- To check satisfactory functioning of all equipment installed
- Clean all equipment to remove foreign material and construction dirt and dust with Vacuum cleaner.
- Verify that the equipment is secure on mounting and supporting devices and that connections for piping, ductwork and electrical are complete.
- Verify proper thermal overload protection is installed in motors, starters, and disconnects.
- Perform cleaning and adjusting specified as per OEM.
- Check proper motor rotation direction and verify fan wheel / pump free rotation and smooth bearing operations.
- Reconnect drive system and align belts.
- Lubricate bearings, pulleys, belts, and other moving parts with factory recommended lubricants.
- Set outside-air / supply air dampers to minimum outside-air setting.
- Install temporary throw away filters for initial run and finally install clean filters.
- Verify manual and automatic volume control, and fire dampers in connected ductwork system are in the full-open position.
- Replace fan and motor pulleys as required to achieve design conditions.
- Measure and record motor electrical values for voltage and amperage.
- Shut unit down and reconnect automatic temperature control operators.
- Cooling / heating capacity of various Indoor units shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Flow measurements shall be by a calibrated rotating vane anemometer and temperature measurements by accurately calibrated mercury-in-glass thermometers. Computed ratings shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current, whereas, noise level at various locations within the conditioned spaces shall be measured by a sound pressure level meter.

NOTE:

- All measuring instruments such as thermometer, Psychrometer, Pressure gauges, anemometers, Flowmeter, dB Meter, Tong tester, etc or any other necessary instrument shall be arranged by the AC contractor at his own expense.
- The instruments shall be new and shall have a valid calibration certificate from a renowned test lab.

- The plant shall be run initially and all equipments shall be adjusted to give desired results as per contract. Thereafter the plant shall be test run for 96 hours as described above and the readings shall be demonstrated in the required format. The test shall be witnessed by the owners and engineer in charges representative. In case the conditions are not achieved during the initial run test the plant shall be readjusted and the new dates for tests shall be determined. The entire test shall be repeated and satisfactory results shall have to be obtained. Only after satisfactory test the installation shall be taken over by the customer and warranty period for one year shall commence.
- The test readings shall be suitably adjusted for the absence of Peak ambient conditions, fouling factor, and available load.
- The snag list prepared jointly after initial test shall be attended to by the vendor during a maximum of 30 days from the start of warranty period. Failure to do so shall result in corresponding increase of warranty period.

APPROVED MAKES OF EQUIPMENT & MATERIALS

S No	Equipment / Material	Approved Makes
1	In-Line fan	Sevcon Lti / Ostberg / Sphere/ Airflow
2	Grilles/ Diffusers	Pineair / Systemaire / Titus / caryaire
3	G.I. Sheet Metal Duct	SAIL/ Tata
4	PVC Pipe	Prince / Supreme.
5	Closed cell Nitrile rubber	Armacell / K flex / Aeroflex
6	Fibre glass	UP twiga / Owen corning
7	PVC Pipe	Prince / Supreme / Finolex.
8	Vibration Isolator	Resistoflex / kanwal industries
9	Factory fabricated Rectangular duct	Ecoduct / Zeco / Rolastar
10	Extruded Al Volume control damper	Pineair / Systemaire / Titus / caryaire
11	Fresh air / exhaust air grills with dampers, bird screen, filter fixing arrangement	Pineair / Systemaire / Titus / caryaire
12	Duct Dampers	Pineair / Systemaire / Titus / caryaire
13	Fire Damper UL listed	Caryaire / Ravistar
14	Motor Control Centre	RR controls / KEPL / UPS
15	Motor	Siemens / Bharat Bijlee / CGL / ABB/Kirloskar
16	Starter, Contactor, Push Button	Larsen & Toubro / Siemens
17	Moulded Case Circuit Breaker (MCCB)	Larsen & Toubro / Siemens
18	Miniature Circuit Breaker (MCB)	GE Power Controls/ Siemens / Havels
19	Overload relays with built in Single Phase Preventer	Larsen & Toubro / Siemens

20	Current Transformer (Epoxy Cast Resin)	Automatic Electric / Indcoil / Pragati
21	Switch Fuse Unit, HRC Fuse	Larsen & Toubro / GE Power Controls / Siemens
22	Rotary Switch	Larsen & Toubro / GE Power Controls / Siemens
23	Timer Delay Relay	Larsen & Toubro / GE Power Control / Siemens
24	Timer	Larsen & Toubro / Siemens
25	Selector Switch, Toggle switch	Larsen & Toubro / Kaycee
26	Change Over Switch	Larsen & Toubro / siemens
27	Ammeter and Voltmeter	Rishabh (L& T) / Automatic Electric
28	Indicating Lamps LED type , Push Button	Larsen & Toubro / Siemens / Vaishno Electricals
29	Cables	Finolex / CCI / Glostar / Skytone/ Polycab/ Haewells.
30	Conduits	BEC / AKG
31	VRV machines	Daikin/Samsung/LG/Toshiba
32	AHU	Edgetech/Zeco

Note: For any other item required for successful completion, but not included in the above list the Contractor shall take prior written approval from the Consultant/ Owner.

PREAMBLE TO SCHEDULE OF QUANTITIES

1 All items of work under this Contract shall be executed strictly to fulfill the requirement laid down under" Basis of Design" in the specifications. Type of equipment, material, specification, methods of installation and testing and type of control shall be In accordance with the specification, approved shop drawing and relevant Indian Standards, however capacity of each component and their quantities shall as fulfill the above mentioned requirement.

2 The unit rate for all equipment‟s or materials cost in RUPEES for equipment and material including all taxes and duties and also including forwarding, freight, insurance and transport into Contractor‟s store at site storage‟ installation „testing balancing „ commissioning and other work required.

3 The rate for each item of work included in the Schedule of Quantities shall‟ unless expressly stated otherwise, include cost of:

- All materials. Fixing materials. Accessories, appliances tools, plants, equipment transport, labour and incidentals required in preparation for and in the full and entire execution as per Specification and Drawings.
- Wastage on materials and labour.
- Loading, transporting, unloading, handling/double, hoisting to all levels. Setting, fitting, and fixing in position, protecting, disposal of debris and other labour necessary in and for the full and entire execution and for the job in accordance with the contract documents, good practice and recognize principals.
- Liabilities, obligations, and risks arising out of Conditions of Contract.

4 All requirements of Specification, whether such requirements are mentioned in the item or not. The Specification and Drawing where available, are to be read as complimentary to and part of the Schedule of Quantities and any work called for in one shall be taken as required for all.

5 In the event of conflict between Schedule of Quantities and other documents including the Specification, the most stringent shall apply. The interpretation of the Engineer in charge shall be final and binding.

6 All equipment, quantities, and technical data indicated in this Schedule are for Contractor‟s guidance only; these are based on the documents prepared by the Consultant. This schedule must be read in conjunction with other documents. The Contractor shall be paid for the actual quantity of work executed by him in accordance with the approved Shop Drawing at the contract rates.

7 This Schedule shall be fully priced and the extensions and totals duly checked. The rates for all items shall be filled in INK including NIL items.

8 No alteration whatsoever is to be made to the text or quantities of this schedule

unless Consultant authorizes such alteration in writing. Any such alterations, cuts or additions shall unless authorized in writing, be disregarded when tender documents are considered.

9 In the event of an error occurring in the amount of the Schedule, as a result of wrong extension of the unit rate and quantity, the unit rate quoted by the tenderer shall be regarded as firm and the extensions shall be amended on the basis of rates.

10 Any error totaling the amount column and in carrying forward total shall be corrected, any error, in description or in quantity, omission of items from this Schedule shall not vitiate this corrected but shall corrected and deemed to be variation required by the engineer in charge.

11 The Contractor shall procure and bring Materials/ Equipment to the site only on the basis of drawing approved for construction and shop drawings and not on the Contractor‟s requisition for Engineer in charge supplied materials.