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**PUBLIC TENDER**

**(TWO PART TENDER) for the following works:**

<b>Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.</b>	
<b>Tender No.</b>	<b>TIFR/PD/CA22-119/221019</b>
<b>Type of Tender</b>	<b>Two Part Tender (Part-I: Technical Bid and Part- II: Price Bid)</b>
<b>Estimated Cost</b>	<b>Rs.36,28,000/-</b>
<b>Cost of EMD</b>	<b>Rs.72,560/-(Demand Draft to be drawn in favour of “TIFR Center for Interdisciplinary Sciences”, Payable at Hyderabad (To be enclosed with the Technical Bid Part – I). However, contractors who have a valid MSME/NSIC certificate are exempted from the tender EMD.</b>
<b>Pre bidding meeting &amp; Time</b>	<b>03.10.2022 at 11:00 Hrs</b>
<b>Last Date for Submission of Tender</b>	<b>11.10.2022 by 13:00 Hrs</b>
<b>Date of Opening Bids(Only Part-I: Technical Bid)</b>	<b>11.10.2022 at 15:00 Hrs</b>
<b>Tender Fee</b>	<b>Rs.500/- (Demand Draft to be drawn in favour of “TIFR Centre for Interdisciplinary Sciences ”Payable at Hyderabad (To be enclosed with the Technical Bid Part –I)). However, contractors who have a valid MSME/NSIC certificate are exempted from the tender fee.</b>

- In case the Part “I” and Part “II” bids are not sealed in separate envelopes the tender will be rejected.
- The technical bid should not contain any indication of the price.
- The Technical Bid received without payment of tender fees and EMD shall be summarily rejected.



- Contacts: Mr. Krishna, Tel: 040- 20203009 for any technical or commercial terms clarifications mentioned in the tender.

Sealed tenders are invited for the aforesaid works from contractors having similar work experience in reputed Research Institutions, Universities, Central Government/Public Sector Undertaking, Private Laboratories, Multinational Companies, etc. Interested contractors who are satisfying prequalification criteria stipulated by TIFR-Hyderabad shall only submit their bids. For further details and any clarification on the tender you may please contact Head-Technical Services, Survey No.36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad-500046.

**Last date for submission of the tender is 11.10.2022 by 13:00 Hrs.**

A handwritten signature in black ink, appearing to read 'Rajasekhar. R.', is written over a faint circular stamp.

**(Rajasekhar. R)**

**Head-Technical Services**



**TENDER DOCUMENT**

**Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.**

**NAME OF THE TENDERER: .....**

**Address: .....**

.....

.....

.....

**Last date of submission of the tender: On or before 11.10.2022 by 13:00 Hrs.**



## **TECHNICAL BID**

### **VOLUME-I**

**Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.**



<b>Tender Notice</b>	:	<b>TIFR/PD/CA22-119/221019</b>
<b>Name of Work</b>	:	<b>Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.</b>
<b>Location</b>	:	<b>Tata Institute of Fundamental Research Survey No. 36/P, Gopanpally village, Serilingampally Mandal, Ranga Reddy District, Hyderabad – 500046.</b>
<b>Estimated Cost</b>	:	<b>Rs.36,28,000/-</b>
<b>EMD</b>	:	<b>Rs.72,560/-(Demand Draft to be drawn in favour of “TIFR Center for Interdisciplinary Sciences”, Payable at Hyderabad (To be enclosed with the Technical Bid Part – I). However, contractors who have a valid MSME/NSIC certificate are exempted from the tenderEMD.</b>
<b>Delivery Period</b>	:	<b>90 Days (Completion Period)</b>
<b>Validity</b>	:	<b>Seventy Five (75) days after opening of Part-I, Technical Bid</b>



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**SECTION-I**

**IMPORTANT INFORMATION**

**INTRODUCTION**

The Tata Institute of Fundamental Research is a National Centre of the Government of India, under the umbrella of the Department of Atomic Energy, as well as a deemed University awarding degrees for master's and doctoral programs. Tata Institute of Fundamental Research Centre for Interdisciplinary Sciences, Hyderabad invites bids for the following work:

**Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.**

**1. PARTICULARS**

a)	Location	TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.
b)	Pre-Bid Meeting Date & Time	03.10.2022 at 11:00 Hrs
c)	Closing date & time of receipt of bids	11.10.2022 by 13:00 Hrs
d)	Date & time of opening of Sealed Cover-I containing Technical Bid	11.10.2022 at 15:00 Hrs
e)	Date of opening of Sealed cover-II containing Financial Bid of eligible bidders	To be intimated to eligible bidders subsequently which is likely to be within 7 days after opening Technical Bid

**2. GENERAL INSTRUCTIONS**

- 2.1. TIFR shall award the contract for the project through the two Bid systems.
- 2.2. The Contractor is advised to visit and examine the site of work and its surroundings and obtain any information that may be necessary, in addition to those provided in this document. The Contractor shall be deemed to have fully acquainted himself about the site condition, whether he inspects it or not.
- 2.3. The Contractor should adhere to the building bye-laws applicable for the area.
- 2.4. All clarifications shall be sought before the date of pre-bid meeting. The bidders may make suggestions which shall be considered during the Pre Bid Meeting. No further clarifications shall be issued after the issue of noteworthy replies to the pre-bid queries.



- 2.5. The submission of the bid by Contractor would imply that they have carefully read and agreed to the terms and conditions contained in this bid document.
- 2.6. The bid for the work shall remain open for acceptance for a period of 90 (Ninety) days from the date of submission of the bids, which period may be extended by mutual agreement and the Contractor shall not cancel or withdraw the offer during this period.
- 2.7. This bid document shall form a part of the contract agreement.

### 3. SUBMISSION OF BIDS

Bids shall be submitted to Head- Technical Services, **TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist, Hyderabad-500046** in a sealed Master envelope super scribed “Bid for **Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR** with our enquiry no. and due date, containing two separate sealed covers clearly super scribed as “**Technical Bid**” and “**Financial Bid**” before the closing date and time of submission in the following manner:

- a) “**Technical Bid**”: This will contain Technical part, Eligibility Documents along with testimonials. Earnest Money Deposit (EMD).
- b) “**Financial Bid**”: This will contain the complete bidding document with duly filled in Schedule of Financial Quote of Financial Bid & Tender Drawings.

The Bids without signature of the authorized person of bidder and seal, without EMD, with conditions or conditional rebates shall be summarily rejected.

### 4. EVALUATION OF BID

- 4.1. **EVALUATION OF TECHNICAL BID**: The bids received will first be first opened and will be examined for EMD/ Declaration Letter, Eligibility Criteria, Conditions, etc. Conditional Tenders and Tenders without EMD/Declaration Letter shall be summarily rejected.
- 4.2. **EVALUATION OF FINANCIAL BID**: The Financial Bid should contain the complete bid document with duly filled in Schedule of Financial Quote of Financial Bid and signed Tender drawings. Financial Bids of Technically qualified Bidders will only be opened. Work will be awarded to lowest bidder (L1) based on their quotes after making necessary arithmetical checks.

### 5. SCOPE & OBJECTIVE

The Objective of the tender is to **Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046** as per the specifications and Bill of quantities mentioned in the Financial Bid.

**Period of Completion of Work:** 90 days from the date of issue of work order





**Defect Liability Period:** 12 months from the date of handing over of completed system as per tender.

**6. PAYMENT SCHEDULE:**

The contractor shall submit the bills for payments along with a detailed statement showing the actual works carried out under different heads of items in the format specified by the TIFR. Minimum value of the work for interim payment (Two Running Bills) shall be Rs.12,70,000/-. All interim and final bills will be settled based on the joint measurements of each item of work and certified by TIFR Engineer. The bills for nonperishable materials on site may also be submitted and the payment by TIFR against the same shall be to the maximum extent of 60% of the value of these materials on production of sufficient documentary evidence ie. Original invoice, Inventory, etc. All interim bills will be paid within **30** days from the date of submission and Final Bill along with all relevant documents will be settled within **30** days from the date of submission with certification of TIFR Engineer.



**SECTION-II**

**ELIGIBILITY CRITERIA FOR TENDER QUALIFICATION**

**Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.**

• **Eligibility criteria:**

1. The Agencies/Contractors shall hold valid labour license issued by appropriate authority and must be valid throughout the contractual period
2. IT Returns for the last three consecutive financial years ended on March 31, 2022 audited by CA.
3. The Agencies/Contractors should have an average annual turnover of Rs.14.51 lakhs during three previous financial years ending March 31, 2022.
4. The Agencies/Contractors should have a latest solvency certificate issued by any nationalized bank of value not less than Rs.14.51 Lakhs.
5. The Agencies/Contractors shall be in profit for the last three financial years and should have valid PAN from Income Tax Authority, GST registration No. etc. and any other registration applicable/mandatory for contract.
6. Submission of technical data sheets of VRF ODUs & AHU (Annexure-V)
7. The Agencies/Contractors should have executed similar installations of Air conditioning systems for Clean rooms or similar works successfully at least
  - 7.1. One similar work costing Rs.29.02 Lakhs or
  - 7.2. Two similar works costing Rs.21.76 Lakhs or
  - 7.3. Three similar works costing Rs.14.51 Lakhs during the last 7 financial years ended on end date of receiving tender for Research Institutes, Universities, Private Laboratories, R & D institutes, etc. in any Government /PSU/Private organizations of repute.

The Agencies/Contractors should furnish copies of work orders and completion certificates from the clients in support of the above.

**Note:**

- ❖ Agencies/Contractors are advised to inspect the site to understand the scope of work comprehensively before submission of tender.
- ❖ Agencies/Contractors should arrange the site inspection to TIFR officials for the qualifying works at their own cost if required.
- ❖ Agencies/Contractors should have a full-fledged in-house project management team to undertake the jobs.



- ❖ The Agencies/Contractors shall **strictly furnish** aforesaid information in the formats/schedules given. **Non adherence to furnishing of information in the given format/schedules given will lead to disqualification of tender.**
- ❖ Instructions to Agencies/Contractors for furnishing the information is given as under:
  - Each page of the application shall be signed by a person having necessary authority to do so.
  - If the space in the proforma is insufficient for furnishing full details, such information may be given in separate sheets.
  - Applicants are required to furnish information against each item of the application. In case a certain item is not applicable, please write NA. Application containing incorrect and or inadequate information is liable to be rejected.



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**SCHEDULE – A**  
**BASIC INFORMATION**

1. Name of the firm :
2. a) Address :
- b) Telephone / Fax No. :
- c) Mobile No. Contact Person :
- d) PAN No. :
- e) GST Registration No. :
- f) Labour License Details :
- Branch Office if any in Hyderabad :
3. Type of Organization (Proprietorships / Partnership) Ltd. Co. / Co-Operative) (Copy of relevant document to be enclosed) :
4. Date of Incorporation :
5. Nature of Business :
6. Experience as prime Agencies/ Contractors (in Yrs.) :
7. Name and address of Bankers :
8. Organization chart of the Company including names and positions of directors / key personnel :

Signature of the Applicant (s)



**SCHEDULE – B**

**Major HVAC works (Copies of the completion certificate to be enclosed)**

A. Similar work of costing Rs.29.02 lakhs or two similar works of costing Rs.21.76 lakhs or 3 similar works of costing Rs.14.51 Lakhs during last 7 financial years ended on end date of receiving tender for Research Institutes, Universities, Private Laboratories, R & D institutes, etc

Sr. No	Name of the project & Address	Description of work in brief	Name of the Engineer	Name of the client also indicate whether Govt or semi Govt or Pvt body with full postal address	Contract Amount in Rs.	Year of commencement	Date of Completion		Whether work was left /uncompleted or the contract was terminated from either side? Give Details.	Any other relevant information relevant information
							Stipulated	Actual		
1.										
2.										

B. List of works in progress above Rs.14.51 lakhs.

S N o.	Name of the project & Address	Description of work in brief	Name of the Engineer with full postal address.	Name of the Client. Also indicate whether Govt. or semi Govt. or Pvt. Body with full postal address	Contract Amount in (Rs.)	Date of Completion	Present stage of work with reasons if the work is getting delayed	Any other relevant information
1.								
2.								

**Signature of the Applicant (s)**



**SCHEDULE – C**

**TECHNICAL PERSONNEL & SPECIAL EXPERIENCE**

List of technical personnel in your establishment giving details about their technical qualification and experience

Sr No.	Name	Age	Qualifications	Project Experience	Nature of works handled	Name of the project Handled	Date from which employed in your organization	Indicate special experience in Air Conditioners installation & Testing projects in which were employed
1								
2								

2. Indicate other points if any to show your technical and managerial competency to indicate any important point in your favour.

Signature of the Applicant (s)



**SCHEDULE – D**

**FINANCIAL POSITION AND WORKING RESULTS**

		2019-20	2020-21	2021-22
1	Annual turnover	:	Rs.	
2.	Net Profit	:	Rs.	
3.	Credit Facilities from the Bank	:	Rs.	
	a) Cash Credit	:	Rs.	
	b) Overdraft Limit	:	Rs.	
	c) Guarantee	:	Rs.	
	d) Others	:	Rs.	
4.	Certificate from the Bankers regarding financial soundness of the applicant	:	Enclosed (Yes / No)	
5.	Solvency Certificate from the Bankers	:	Enclosed (Yes / No)	

Signature of the Application (s)



**SCHEDULE – E**

**MISCELLANEOUS INFORMATION**

- 1      Whether it would be possible to process Bank      :  
  
        Guarantee for various advances  
        during execution of the work.
  
- 2      Details of Civil Suits / Litigations arised during      :  
        execution of the contracts in the last 5 years.
  
- 3      Latest Income Tax Clearance Certificate      :
  
- 4      Name of the two senior official      :  
        Organizations preferably Govt./Semi Govt/  
        Autonomous/ Public Sector Organization for  
        whom you have executed important and  
        major Electrical works, who may be directly  
        contracted by TIFR to gather information  
        about your ability, competence and capacity  
        of your work/organization/etc.
  
- 5      Number of Supplementary sheets attached.      :

Signature of the Applicant (s)





<b>SECTION-III</b>	<b>NOTICE &amp; INSTRUCTIONS</b>
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1. **Sealed item rate tenders** in the prescribed form are invited from Head-Technical Services, Tata Institute of Fundamental Research, Centre for Interdisciplinary Services, Hyderabad, for the following:

<b>Tender Notice No.</b>	<b>TIFR/PD/CA22-119/221019</b>
<b>Name of Work</b>	<b>Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.</b>
<b>Estimated Cost</b>	<b>Rs.36,28,000/-</b>
<b>Time Limit</b>	<b>90 days (Completion Period)</b>
<b>Earnest Money Deposit</b>	<b>Rs.72,560/- (Demand Draft to be drawn in favor of "TIFR Centre for Interdisciplinary Sciences "Payable at Hyderabad (To be enclosed with the Technical Bid Part -I)). However, contractors who have a valid MSME/NSIC certificate are exempted from the EMD.</b>
<b>Tender Fee</b>	<b>Rs.500/- (Rupees Five Hundred only)</b>
<b>Last Date &amp; Time of Submission of Tender</b>	<b>11.10.2022 by 13:00 Hrs</b>
<b>Date &amp; Time of Opening of Technical Bid</b>	<b>11.10.2022 at 15:00 Hrs</b>

2. **Submission of Tender & Opening:**

Tenders shall be submitted in a sealed envelope super scribed with Tender enquiry No., Due Date and with heading as **"Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046."** containing two separate sealed covers clearly super scribed as **"TECHNICAL BID"** and **"FINANCIAL BID"** on or before the closing date and time of submission in the following manner:

**"TECHNICAL BID"**: This will contain the following:

- a) Proof of Tender Cost paid already
- b) Earnest Money Deposit as stipulated



c) Schedules giving information on Eligibility Criteria with supporting documents specified for tender qualification.

**“FINANCIAL BID”:** Signed copy of the Financial Bid quoting amount in the stipulated format and signed copies of the tender drawings.

**3. Earnest Money Deposit (EMD):** EMD shall be submitted in the form of Demand Draft / Pay Order / Banker’s cheque issued by a Scheduled Bank, drawn in favor of **“TIFR Center for Interdisciplinary Sciences”**, (To be enclosed with the Technical Bid (Part-I))

**Earnest Money Deposit (EMD):** Every Bidder has to pay EMD of amount as specified elsewhere in this tender by Demand Draft in favor of **“TIFR Center for Interdisciplinary Sciences”** along with the offer or submit valid MSME certificate & declaration for exemption if any. Quotation received without EMD shall be rejected and no correspondence whatsoever will be entertained. For successful bidder the EMD will be adjusted against Performance Guarantee and will be refunded after completion of work /supply of material at site and for unsuccessful bidders EMD will be refunded after placing the order to successful bidder.

**4. Performance guarantee/Security Deposit:**

The tenderer, whose tender is accepted, will be required to furnish a performance guarantee/security deposit of 3% of the tendered amount within 7 (seven) working days from the date of intimation. This guarantee shall be in the form Demand Draft / Pay Order / Banker’s cheque / Deposit or Government Securities / Fixed Deposit Receipt (FDR) or Guarantee Bonds (BG) of any Scheduled Bank in accordance with the form as Annexure – I hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to TIFR as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to TIFR to make good the deficit.

The Performance Guarantee/Security Deposit shall be initially valid up to 12 months from date of commissioning. The performance guarantee shall be returned to the contractor, without any interest, after recording of the completion certificate for the work by the competent authority.

The Engineer-in-charge shall make a claim under the Performance guarantee for amounts to which TIFR entitled under the contract (notwithstanding and / or without prejudice to any other provisions in the contract agreement) in the event of:

- a) Failure to attend and rectify the problems in the guarantee period, in which event the Engineer- in-charge may claim the full amount of the Performance guarantee.
- b) Failure by the contractor to pay TIFR, Hyderabad any amount due, either as agreed by the contractor or determined under any of the Clauses / Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-charge.



In the event of the contract being determined under provisions of any of the relevant clauses of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of TIFR, Hyderabad.

**5. Acceptance of Tender:** The competent authority, on behalf of TIFR, Hyderabad does not bind itself to accept the lowest or any other tender, and reserves to himself the authority to reject any or all the tenders received, without assignment of any reason. All tenders, in which any of the prescribed conditions is not fulfilled or any condition, including that of conditional rebates, is put forth by the tenderer, shall be summarily rejected.

The Competent Authority, on behalf of TIFR, Hyderabad reserves to itself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rates quoted. 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 tender or any other tender.

**6. Validity of Tender:** The tender for the work shall remain open for acceptance for a period of 90 days from the last date of submission of tenders. If any tenderer withdraws his tender before the said period, or before issue of Letter of Intent, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the Department, then TIFR, Hyderabad shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money absolutely. Further the tenderer shall not be allowed to participate in the retendering process of the work.

**7. Levy / Taxes payable by contractor:**

- i. GST or any other tax on materials and services in respect of this contract shall be payable by the contractor and TIFR shall not entertain any claim whatsoever in this respect.
- ii. The contractor shall deposit royalty and obtain necessary permit as required for supply of the sand, aggregate, stone etc. from local authorities.

**8. Deduction of Income Tax :** As per Section 194-C of Income tax Act 1961, as amended by letter No. 275/9/72/9-TJ (Circular No. 86) dated 19.5.72 and No. 275/14/91-IT (B) (Circular No. 593) dated 5.2.91, received from Ministry of Finance, Department of Revenue, Central Board of Direct Taxes, New Delhi, the Income tax @ 2% and Surcharge thereon @12% (or any other amended rate by Ministry of Finance from time to time), of the gross value of the work done will be recovered from the bills. A certificate for the amount so recovered will be issued by the Department.

**9. Site visit by the tenderer before tendering:** Tenderers are advised to inspect and examine the site and its surroundings during working hours 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 charges consequent on any misunderstanding or otherwise shall be allowed.

**10. Signing of Tender and receipts for payments:** In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed 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. Receipts for payments made 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.

**11. Tenderer's responsibilities:** The tenderer shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, 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 they have read this notice & all other contract documents, and has made himself aware of the scope & specifications of the work to be done and local conditions and factors having a bearing on the execution of the work.

**12. Signing of contract:** The Notice Inviting Tender shall form a part of the contract document. 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: the Notice Inviting Tender, all the documents including all conditions, specifications and drawings, if any, forms the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

**13. Canvassing,** either directly or indirectly, in connection with the tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection and may be barred from future participation in TIFR works.

**Head-Technical Services**  
*For and on behalf of TIFR, Hyderabad*



**SECTION-IV**

**GENERAL CONDITIONS OF CONTRACT**

**1. Definition of Terms:**

1.1. In constructing these general conditions and the specifications the following works shall have the meanings herein assigned to them unless there is something in the subject or context inconsistent with such construction.

1.2. The 'Purchaser' shall mean Tata Institute of Fundamental Research- -Hyderabad, Tata Institute of Fundamental Research, 36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad 500046 and shall include the Purchaser's heirs, successors and assigns.

1.3. The term 'Engineer In-Charge' and 'Engineer' shall mean Engineer In-Charge, TIFR-Hyderabad or some other person for the time being or from time to time duly appointed in writing by the Purchaser to act as Engineer In-Charge for the purpose of the Contract or in default of such appointment the Purchaser.

1.4. The term 'Contractor'/'Supplier'/'Bidder'/'Vender' shall mean the Bidder whose tender has been accepted by the Owner and shall include the Bidder's heirs, successors and assigns approved by the Purchaser:

1.5. The term 'Sub-Contractor' shall mean the firm or persons named in the contract for any art of the work or any person to whom any part of the work has been sublet with the consent in writing of the Engineer In-Charge and shall include his heirs, successors and assigns approved by the Purchaser.

1.6. The Term 'Inspector' shall mean any person appointed by or on behalf of the Purchaser to inspect supplies, stores or work under the contract or any person deputed by the Inspector for the purpose.

1.7. The term 'Particulars' shall mean, the following :

1.7.1. Specifications

1.7.2. Drawing (ANNEXURE-IV)

1.7.3. Sealed Pattern denoting a pattern sealed and signed by the Inspector.

1.7.4. Proprietary make denoting the product of an individual firm.

1.7.5. Any other details governing the construction, manufacture and/or supply as existing for the contract.

1.8. The term 'Specification' shall mean the specifications annexed to or issued with these Conditions of Contract.

1.9. The term 'Site' shall mean the place or places at which the Equipment is to be delivered or work done by the Contractor; and shall include, where applicable, the lands and buildings upon or in which the works are to be executed and shall also include the place or places at which fabrication and other work is being carried out by the Contractor.

1.10. 'Electrical Equipment', 'Stores', 'Work' or 'Works' shall mean and include equipment and materials to be provided and work to be done by the Contractor under the Contract.

1.11. The 'Contract' shall mean acceptance of the work order placed on contractor/supplier under section (2) of these conditions and shall include these conditions of Contract, Specifications, Schedule, Drawing, Letter of Intent of the Purchaser and any subsequent amendments mutually agreed upon.



1.12. 'Tests on Completion' shall mean such tests which are prescribed by the specifications or have been mutually agreed to between the Contractor/Supplier and the Purchaser to be made before the equipment is taken over by the Purchaser.

1.13. 'Writing' shall include any manuscript, typewritten or printed statement under or over signature or seal as the case may be. Words importing 'person' shall include firms, companies, corporations and association of individuals whether incorporated or not.

1.14. Words importing singular shall also include plural and vice versa where context requires.

1.15. Bidders are advised to visit and inspect the work-site to make themselves fully conversant with the site conditions and nature of work. Any claim by them after the opening of bids on account of themselves being unaware of any site condition shall not be entertained.

## **2. Contract**

Contractor/Supplier/Manufacturer should send their acceptance letter on receipt of 'Letter of Intent' or 'Work Order' or 'Purchase Order' within the stipulated period. On expiry of said period or exorbitant delay in commencing or executing the work, the Purchaser shall not be liable to any claim from the Contractor/ Supplier for work entrusted to and may revoke the contract.

## **3. Work at Site**

3.1. Access to the works shall be allowed only to the Contractor/Supplier, Sub-Contractors or his duly appointed representatives. The Contractor/ Supplier shall not object to the execution of other works by other contractors or tradesmen and shall afford them every facility for execution of their several works simultaneously with his own.

3.2. Work at the Purchaser's premises shall be carried out at such time as the Purchaser may approve but the Purchaser shall give the Contractor/ Supplier all reasonable facilities for the same. The Contractor/Supplier shall provide sufficient fencing, notice boards etc. to guard the works and warn the public.

3.3. The Contractor shall obey Central, Local and State regulations and enactments pertaining to workmen and labour and the Engineer In-Charge shall have the right to enquire into and decide all complaints on such matters. The Contractor should comply with the Minimum Wages Act and should also ensure that safe practices are followed by his people at site.

## **4. Delays**

The Contractor/Supplier shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work, whatever the cause for such delays may be, including delays in procuring Government controlled or other materials and delay in obtaining instructions and decisions from the Engineer In-Charge.

## **5. Taking Over**

The equipment when erected at site shall be deemed to have been taken over by the Purchaser when the Engineer In-Charge will have certified in writing that the equipment has fulfilled the contract conditions.

## **6. Extension of Time**

If the Contractor/Supplier is delayed in the progress of work by changes ordered in the work, or by any cause, which the Engineer In-Charge shall decide to justify the delay, then the time of completion shall be extended by a reasonable time. In this regard, Contractor shall maintain proper hindrance register and record all such events with due signature of E-I-C on occurrence of such instants for seeking extension of time. However, no such extension shall be allowed unless requested for extension is made in writing by the Contractor/Supplier to the Engineer In-Charge within 15 days from the date of occurrence of the delay.

## **7. Liquidated Damages**

7.1. For all delays, which do not merit any extension of time, the Contractor/ Supplier shall attract 1% penalty per week for the first 4 weeks of delay and 2% penalty per week for the next 4 weeks of the total contract value. The amount of liquidated damages shall be recoverable from the payment due to the Contractor/Supplier up to maximum of 10% of value of contract.

7.2. The deduction of liquidated damages shall not, however, absolve the Contractor/Supplier of his responsibility and obligations under the contract to complete the work in its entirety and shall also be without prejudice to action by the Purchaser under clause:

‘Termination of Contract by the Purchaser’. After that the same shall be completed by the Purchaser at the Contractor’s/Supplier’s risk and cost.

## **8. Other Damages:**

8.1. The Contractor/Supplier/Manufacturer shall be responsible for all injury to persons, animals or things and for all damage to the works, structure of, and decorative work in the property which may arise from operation or neglect of himself or any of his Subcontractor or of his or Sub-Contractor’s employees, whether such injury or damage may arise from carelessness, accident or any other cause whatever in any way connected with the carrying out of this contract. This clause shall be held to include any damage to buildings, whether immediately adjacent or otherwise, any damage to roads, streets, foot paths, as well as all damage caused to the works forming the subject of this contract by frost or other inclemency of weather. The Contractor/Supplier shall indemnify the Purchaser and hold him harmless in respect of all and any expenses on property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of Government or otherwise and also in respect of any award of compensation or damages consequent upon such claim. Contractor shall furnish necessary insurance documents (Contractor All Risk Policy) taken for the site before commencement of work.

8.2. The Contractor/Supplier/Manufacturer shall reinstate all damage of every sort mentioned in this clause, so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of the Owner/third parties.

8.3. The Contractor/Supplier/Manufacturer shall indemnify the Purchaser against all claims which may be made against the Purchaser, by any member of the public or other party, in respect of anything which may arise in respect of the works or in consequence thereof and shall, at his own expense, effect and maintain, until the work has been ‘Taken Over’ under clause 5.



8.4. The Contractor/Supplier/Manufacturer shall also indemnify the Purchaser against all claims which may be made upon the Purchaser whether under the Workmen's Compensation Act or any other statute in force during the currency of this contract or at common law in respect of any employee of the Contractor/Supplier or of any of his sub-contractor and shall at his own expense effect and maintain until the work has been 'Taken Over', with an approved office. Contractor shall furnish a copy of the labour licence before commencement of work. If the aforesaid are not applicable contractor should furnish declaration to this effect and shall indemnify TIFR-Hyderabad, Hyderabad for violation of any such compliances.

8.5. The Purchaser, with the concurrence of the Engineer In-Charge, shall be at liberty and is hereby empowered to deduct the amount of any damages compensation costs, charges and expenses arising or accruing from or in respect of any such claims or damages from any sums due to or become due to the Contractor/Supplier.

**9. Guarantee and Defects Liability Period:**

9.1. The Contractor/Supplier/Manufacturer shall guarantee that all equipment shall be free from any defect due to the defective materials and bad workmanship and that the equipment shall operate satisfactorily and that the performance and efficiencies of the equipment shall be not less than the guaranteed values. The guarantee shall be valid for a period of 12 months after the date of commissioning as certified by the Engineer In-Charge. Any parts found defective shall be replaced free of all costs by the Contractor/Supplier. The services of the Contractor's/Supplier's personnel if requisitioned during this period for such work shall be made available free of any cost to the Purchaser.

9.2. If the defects be not remedied within a reasonable time, the Purchaser may proceed to do so at the Contractor's/Supplier's risk and expense without prejudice to any other rights.

**10. Terms of Payment**

The contractor will be paid only 2 Running Account (RA) Bills and Final Bill considering the progress of works based on measurement of works completed. The contractor shall submit the bills for payments along with a detailed statement showing the actual works carried out under different heads of items in the format specified by TIFR-, Hyderabad. Minimum value of the work for interim payment shall be Rs.12,70,000/-





BILL FORMAT

Tender Item No.	Description of Items (At least 2 lines)	Unit	Tender Quantity	Executed Quantity	Rate	% work done	Amount

NOTE: All quantities in the bill should be cumulative.

All measurements should be in the order of tender sequence and should be recorded in the measurement book. The Measurement should be strictly in the below mentioned format only.

MEASUREMENT FORMAT

Tender Item No.	Description of Item & Location against each Measurement taken	Nos.	Length	Breadth /width	Height	Qty.	Remarks

The works which have been certified for running bills will also be verified along with the final bill and any defects found need to be replaced / rectified by the contractor at his cost. Till the time, the site is handed over in full, it is the contractor's liability to safeguard the works done and completed at site. The Progress of work should not be affected in any way quoting the reason of non-availability of funds / materials / releasing of Running bill. The liability of the contractor is to complete all works in his scope in the scheduled time as per the terms of contract and will not relieve the contractors from his obligations once the Running bill is paid / kept pending.



### Final Payment

Payments of Final bill shall be made after deduction of security deposit /Performance guarantee as specified. The Security Deposit / Performance guarantee, shall be refunded on expiry of the Defects Liability Period after rectifying all defects to the satisfaction of the TIFR-Hyderabad/E.I.C. The acceptance of payment of the final bill by the Contractor would indicate that he would have no further claim in respect of the work executed.

## **11. Special conditions of Contract governing supplies of the Equipment of this Tender:**

### **11.1. Scope:**

- 11.1.1. This specification covers the supply of material as per the enclosed details and quantities and supervision of erection/installation, testing and commissioning of the material.
- 11.1.2. The Contractor/Manufacturer/Supplier shall quote for all the materials along with accessories as mentioned in the enquiry.
- 11.1.3. All the supply shall be in accordance with relevant I.S. Specifications and recognized standards.

### **11.2. Inspection & Testing of Material:**

- 11.2.1. Contractor/Manufacturer/Supplier shall submit the lists of Type Tests and Routine Tests to be conducted on the material in the Technical Data Sheet.
- 11.2.2. All the materials shall be tested at factory as per IS Specifications of material by Purchaser's Engineer In-Charge/Engineers before dispatch at the cost of Contractor/Manufacturer/Supplier.
- 11.2.3. Contractor/Manufacturer/Supplier shall inform the concerned Engineer In-Charge for inspection and testing in accordance and fix up a suitable date for the same.

### **11.3. Test Certificates:**

Contractor/Manufacturer/Supplier shall submit the Test Certificates of all materials.

### **11.4. Taxes & Duty:**

- 11.4.1. Contractor/Manufacturer/Supplier shall quote the basic price of material. Excise Duty, Custom Duty, Sales Tax, GST, Octroi, Delivery Charges, Transit Insurance and/or any other charges, if any, must be indicated separately.
- 11.4.2. TIFR being a research institute of Govt. of India, is eligible for Excise Duty Exemption on equipment supplies. Necessary exemption certificate will be provided by TIFR.
- 11.4.3. Transit Insurance: The Transit Insurance from the point of dispatch to the site of erection shall be in the scope of Supplier and the cost shall be indicated separately.

**11.5. Delivery of Material:**

- 11.5.1. The Contractor/Manufacturer/Supplier shall be held responsible for loading of all equipment and for the stores being sufficiently and properly packed for transport by rail, road, sea or air so as to ensure their being free from any loss or damage on arrival at destination. The packing and marking of packages shall be done by and at the expenses of Manufacturer/Supplier. Each package shall contain a packing note quoting purchase order number and detail of the contents.
- 11.5.2. All the materials must be delivered at site i.e. Hyderabad - TIFR at 36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad-500046. The unloading and positioning of all equipment at the designated locations specified by the Engineer In-Charge shall be in the scope of the Supplier. The Supplier shall arrange for handling equipment, labour for rigging, etc. as required.
- 11.5.3. Material must be delivered at site in all respects as mentioned in the Purchase Order.

**11.6. Guarantee:**

If during the period of guarantee any fault or defect arises, the material shall be replaced/repared immediately free of cost, as well as any replacement of accessories required shall be done free of cost.

**11.7. Mistake in Drawing:**

The Contractor/Supplier shall be responsible for and shall pay for any alterations in works due to any discrepancies, errors or omissions the drawings or other particulars supplied by him whether such drawings or particulars have been approved by the Purchaser or not.

**11.8. Responsibility for Completeness:**

Any fittings or accessories which may not be specifically mentioned in the specifications but which are usual or necessary are to be provided by the Contractor/Supplier without extra charge and the equipment must be complete in all details.

**11.9. Extra/Deviation items & Variations in quantity**

**TIFR-Hyderabad has the right to omit/delete any of the items and also increase/decrease the quantities mentioned in the tender. No claim or any compensation in this regard will be accepted or paid to the contractor. However, if any new /additional items/deviated items are to be executed, the contractor is bound to execute such items with prior approval from TIFR-Hyderabad after furnishing the proper rate analysis for such extra/deviated items**

**11.10. Rejection of Defective Equipment:**

- 11.10.1. If the equipment after the acceptance thereof is discovered to be defective, notwithstanding that such defects could have been discovered at the time of inspection or found to have failed to fulfill the requirements of the contract or developed defects after the erection within a period of 12 months from the date of erection, even if such erection is done by the Purchaser, he shall be entitled to give a notice on the Contractor/Supplier setting forth details of such defects or failure and the Contractor/Supplier shall, provided such notice is given within a period of 14 months from the date of such erection or acceptance, forthwith make the defective equipment good or alter the same to make it comply with the requirements of the contract at his own cost and further if in the opinion of the Purchaser, the defects are of such a nature that the defects cannot be made good or required without impairing the efficiency or workability of the equipment or if in the opinion of the Purchaser the Equipment cannot be repaired or altered to make it comply with the requirements of the Contract, the Contractor/Supplier shall, provided a notice given by the Purchaser in this behalf within a period of 14 months from the date of erection or acceptance thereof, remove and replace the same with the equipment conforming to the stipulated particulars, in all respects at the Contractor's/Supplier's own cost. Should he fail to do so within a reasonable time, the Purchaser may reject and replace, at the cost of the Contractor/Supplier, with equipment of the same particulars or if equipment conforming to the stipulated particulars are not in the opinion of the Purchaser readily procurable, such opinion being final, then with the nearest substitutes.
- 11.10.2. In the event of such rejection the Purchaser shall be entitled to use the Equipment in a reasonable and proper manner for a time reasonably sufficient to enable him to obtain replacement equipment as herein before provided.

**11.11. Inspection and Final Tests:**

All tests necessary to ensure that the Equipment complies with the particulars and guarantee shall be carried out at such place or places as may be determined by the Inspector. Should, however, it be necessary for the final test as to performance or guarantee to be held over until the Equipment is erected at site they shall be carried out within one month of completion of erection.

**11.12. Intimation about Delivery:**

If the Purchaser shall have notified the Contractor/Supplier in writing that the former is not ready to take delivery, no equipment or materials shall be forwarded until an intimation in writing shall have been given to the Contractor/Supplier by the Purchaser that he is ready to take delivery.

**11.13. Delay in erection:**

Wherever erection of an equipment or machinery is the responsibility of the Contractor/Supplier as a term of the contract and in case the Contractor fails to carry out the erection as and when called upon as to do within the period specified by the Purchaser, the Purchaser shall have right to get the erection done through any source of his choice. In such an event, the Contractor/Supplier shall be liable to bear any additional expenditure that the Purchaser may incur towards erection. The Contractor/Supplier shall, however not be entitled to any gain due to such an action by the Purchaser.

**11.14. Definition of Equipment:**

The work 'Equipment' wherever, it appears in these 'Special Conditions of Contract' governing supplier of Equipment in this Tender shall mean all switchgears, panels, etc. or parts thereof or what the Contractor/Supplier agrees to supply under Contract as specified in the work order.

**11.15. Force Majeure:**

Normally Force Majeure shall cover only acts of God, fire, wars, strike, riots and civil commotion, floods, epidemic, quarantine related strikes, freight embargoes, etc. The contractor shall not be liable for any liquidated damages for delay or any failure to perform the contract arising out of Force Majeure conditions, provided that the contractor shall within ten days from the beginning of such delay notify the department in writing the cause of delay along with convincing supporting evidence. The department once convinced and accepted the reason may extend the supply completion period by a suitable / reasonable margin.

**11.16. Termination of Contract by the Purchaser:**

11.16.1. If the Contractor/Supplier commits any 'Act of Insolvency' or shall be adjudged an Insolvent or shall have an order for compulsory winding up made against him or pass effective resolution for winding up voluntarily, or if the Contractor/Supplier shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the Contractor/ Supplier, or shall assign the Contract without the prior consent in writing of the Engineer In-Charge, or shall charge or encumber this Contract or any payments due or which may become due to the Contractor/Supplier there under, or if the Engineer In-Charge shall certify in writing to the Purchaser that the Contractor/Supplier –

11.16.1.1. has abandoned the Contract, or

11.16.1.2. has failed to commence the works, or has without any lawful excuse these conditions suspended the progress of the works for seven days after receiving from the Engineer In-Charge written notice to proceed, or

- 11.16.1.3. has failed to proceed with the work with such due diligence and failed to make such due progress as would enable the works to be completed in accordance with the approved programme of work,, or
- 11.16.1.4. has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Engineer In-Charge written notice that the said materials or work were condemned and rejected by the Engineer In-Charge under these conditions, or
- 11.16.1.5. has neglected or failed persistently to observe and perform all or any of the acts matters or things by this contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor/ Supplier requiring the Contractor/Supplier to observe or perform the same, or
- 11.16.1.6. has to the detriment of good workmanship or in defiance of the Engineer In-Charge's instructions to the contrary sub-let any part of the contract, then and in any of the above said causes, the Purchaser with the written consent of the Engineer In-Charge may, notwithstanding any previous waiver, after giving seven days' notice in writing under the provisions of this clause to the Contractor/Supplier, determine the contract but without prejudice to the powers of the Engineer In- Charge or the obligations and liabilities of the Contract, the whole of which shall continue to be in force as if the contract has not been so determined and as if the work subsequently executed has been executed by and on behalf of the Contractor/ Supplier.
- 11.16.2. After the issue of such notice, the Contractor/Supplier shall not be at liberty to remove from site any equipment, tools and materials belonging to him which shall have been placed thereon for the purpose of the works and the Purchaser shall have lien upon such equipment, tools or materials to subsist from the date of such notice and until the notice shall have been complied with.
- 11.16.3. If the Contractor/Supplier shall fail to comply with the requirements of said notice for seven days after such notice has been given, the Purchaser shall have the power to enter upon and take possession of the works and site and all equipment, tools and materials thereon, and to engage any other person, firm or agency to complete the works, utilizing the equipment, tools and materials to the extent possible. The Purchaser shall not in any way be responsible for damage or loss of the tools, equipment and materials and the Contractor/Supplier shall not have any compensation therefore.
- 11.16.4. Upon completion of the works, the Engineer In-Charge shall certify the amount of expenditure properly incurred consequent on and incidental to the default of the Contractor/Supplier as aforesaid and such amount shall be deducted from the payments due to the Contractor/Supplier, including the Security Deposit. If the said amount exceeds the payment due to the Contractor/Supplier, the Purchaser

shall be at liberty to dispose off any of the Contractor's/Supplier's materials, tools or equipment and apply the proceeds for the payments due from the Contractor/Supplier and recover the balance by process of law.

- 11.16.5. After the works have been completed after the amounts due to the Contractor/Supplier, the Engineer In- Charge shall give notice in writing to the Contractor/Supplier to remove the surplus equipment and material from site. If such equipment and materials are not removed within a period of 14 days after such notice, the Purchaser shall have the power to remove and sell the same holding the proceed less the cost of removal and sale, to the credit of the Contractor/Supplier. The Purchaser shall not be responsible for any loss sustained by the Contractor/Supplier from the sale of the equipment and material.

**13. Contractor's Representative:**

- 13.1. The Contractor/Supplier shall employ at least one qualified representative (ie. Electrical supervisory License with minimum 3 years of experience of similar works as stipulated by TIFR- Hyderabad in the work order) whose name shall have previously been communicated in writing to the Engineer In-Charge and approved by him to supervise the erection. Any written order or instructions given to the representative shall be deemed to have been given to the Contractor/Supplier. The Engineer In-Charge shall be at liberty to object to any particular representative/or any persons employed by the Contractor/Supplier on the work and the Contractor/Supplier shall remove the person objected to, on the receipt of the Engineer In-Charge, in writing, a request requiring him to do so and shall provide in his place another competent representative acceptable to the Engineer In-Charge.
- 13.2. The Contractor's/Supplier's representative shall be a qualified electrical/ mechanical engineer possessing adequate site experience in similar nature of works.

**14. Completion Time:**

Unless otherwise agreed in writing between the Purchaser and the Contractor/Supplier, the work contract shall be completed within the stipulated period mentioned elsewhere in this tender document from the date of Work/Purchase Order issued to Contractor/Supplier by the Purchaser.

**15. Delivery of Material at Site:**

The Contractor/Supplier/Manufacturer shall arrange for safe transit and delivery of material at site and unloading the material at site.

**16. Validity of Tender:**

The quotation should be valid for 75 days after opening of the Part—I: Technical Bids.

**17. Measurements:**

All joint measurements of quantities shall be done by the Contractor at his own cost in the presence of the Engineer In-Charge or any authorized person deputed by him who will certify the routes, length and quantities etc. for the purpose of determination of the amount payable.

**18. Spare Parts & Manuals:**

Manufacturer/Contractor/Supplier should submit operation, maintenance and spare part list and manuals for all equipment.

**19. Training:**

Manufacturer/Contractor/Supplier should provide training for operation and maintenance free of cost for equipment supplied.

**20. Special Instruction for bidding process**

This tender is a two part tender. The Part-I: Technical Bid and Part-II: Financial Bid. Bidders shall seal each bid separately with a clear label on the envelope about its content. Both the bids should be submitted in a single drop two cover method. Any pricing details must not appear in the Part-I: Technical Bid.

**21. Drawings and Documentation:**

As-built drawings as specified in this technical specifications shall be submitted by the Contractor.

**22. Permissions and Approvals:**

All statutory permissions and approvals from Electricity authority as may be required for commissioning of the entire system shall be carried out by the contractor. All necessary documentation for obtaining such permissions and approvals shall be done by the contractor. Purchaser shall assist in providing required declarations. Statutory fees shall be paid by the purchaser.

**23. Guarantee:**

The equipment shall be guaranteed against all design and manufacturing defects, poor workmanship etc. for a period of 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier. Any defects discovered during this period shall be rectified by the vendor free of cost to the purchaser.





**SECTION-V**

**TECHNICAL SPECIFICATIONS**

**1. SCOPE**

Supply, Installation, Testing and Commissioning of HVAC system as per the given design, BOQ and as per the site conditions for the 10000 class clean room in complete.

**2. SELECTION CRITERIA**

AHUs shall be selected for the air quantity, capacity and static as mentioned in the BOQ. The following specifications are to be followed.

**2. 1. FLOOR MOUNTED HORIZONTAL AIR HANDLING UNITS:**

AHUs shall be selected for the air quantity, capacity and static as mentioned in the BOQ. The following specifications are to be followed.

Type of AHU	:	Double Skin
Air quantity and static pressure	:	As specified in the BOQ
Type of fan	:	Direct driven Plug fan with one fan working and one fan standby.
AHU sections	:	Mixing Box Section, Filter section, coil section, fan section and fine filter section
Maximum velocity across the coil	:	500 FPM
Maximum velocity across the filter	:	400 FPM
Maximum air velocity at fan outlet	:	9.5 mt. / sec
Coil face area	:	Full Face Area
Minimum coil rows deep	:	6 Row As per BOQ
Coil fins per inch	:	12 FPI
Inner sheet thick	:	0.8 mm GI plain sheet
Outer sheet thick	:	0.8 mm pre plasticized / pre-coated GI

Panel thickness	:	50± 2 mm
Aluminum profiles	:	Thermal break profiles with internal coving
Return / Fresh / Bleed air / Supply dampers	:	AL aerofoil opposed blade type
Motor	:	TEFC motor
Pre and Commissioning Filters	:	EN 779 : G4 pre filter – 50mm deep
Fine Filters	:	EN 779 : F9 fine filter – 300mm deep
Pressure sensing probes	:	Shall be provided for pre filters and fine filters to install magnehelic gauges.
Noise level	:	Should not exceed 65 dBA @ one meter distance from AHU.

- AHU shall have viewing port in fan section, limit switch for access door in the fan section, marine lamp with switch in mixing box section, blower section and fine filter section.
- AHU's and coils shall be suitable for VRF ODUs. Necessary coil kits with corded remote, controls & controller etc., shall be considered. Coil shall have multiple circuits to suits number of VRF ODUs.
- AHU shall be offered for factory inspection after complete assembly for physical inspection, run test and performance test.

**2.2. DUCTING:**

Factory / site fabricated : Factory fabricated  
 GSS sheet : IS 277 – 120 grade  
 Fabrication standard : SMACNA – 2005 – 1000 Pa  
 Transverse Joints : MS angle frames  
 Supports : GI threaded rod and slotted rail  
 Bolt & Nuts : 6 mm GI bolt & nuts with two side washers shall be used  
 at a distance of < 150mm

Ducting length shall be 4ft or less as per the approved drawings and as per the site conditions. Elbows, partial elbows, taper pieces and other fittings shall be as per the drawing and as per site conditions.

Factory / site fabricated	:	Factory fabricated
GSS sheet	:	IS 277 – 120 grade
Fabrication standard	:	SMACNA – 2005 – 1000 Pa
Transverse Joints and bracing	:	MS angle frames
Supports	:	GI threaded rod and slotted rail
Bolt & Nuts	:	6 mm GI bolt & nuts with two side washers shall be used at a distance of 100mm

Ducting length shall be 4ft or less as per the approved drawings and as per the site conditions. Elbows, partial elbows, taper pieces and other fittings shall be as per the drawing and as per site conditions.

### **2.3. VENTILATION UNITS:**

Type of unit	:	Double Skin
Fan	:	EC Fan with necessary controls
Maximum air velocity at fan outlet	:	9.5 mt. / sec.
Motor Efficiency	:	High Efficiency Motor
Maximum velocity across filters	:	500 FPM
Inner sheet thick	:	0.63 mm or 24 G GI
Outer sheet thick	:	0.63 mm or 24 G pre plasticized sheet
Insulation thickness	:	25 mm
Aluminum sections	:	Non thermal break profile
Outlet dampers	:	Al aerofoil opposed blade type
Motor	:	TEFC
Motor RPM	:	1450
Drive	:	Direct

Exhaust air units shall have the filters. Exhaust units shall have plenum for duct connection. Units on the terrace shall have cowl and bird screen.

Ventilation fans shall have a limit switch for access door in the fan section and marine lamp with switch in fan section.

### **2.4. DUCT THERMAL INSULATION:**

Thickness	:	Supply Air Duct with 25mm thick
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	: Return Air Duct with 19mm thick
Material	: Class 'O' nitrile rubber insulation
Finish	: All joints shall be finished with 50mm wide
Self-adhesive tape.	
Density	: 40-60 Kg/ cub. Mt.
Thermal conductivity at 0 deg C.	: 0.033 W/mt. deg. K
Water permeability	: 10000 u
Adhesive	: Low VOC

All exposed ducting shall be insulated with Class 'O' nitrile rubber insulation of thickness 25mm thick for supply & 19mm thick for return ducts (40kg/m<sup>3</sup> density) running in non-air conditioned areas and outside the building. The insulation shall be finished with polythene paper and 24G chicken wire mesh and finished with 24G aluminum cladding.

### **2.5. DUCT ACOUSTIC INSULATION:**

Thickness	: 15 mm thick
Material	: Class '1' Open closed cell nitrile rubber Insulation.
Density	: Min. 140 Kg/ cub. Mt.
Thermal conductivity at 20 deg C.	: 0.047 W/mt. deg. K
Water permeability	: 10000 u
Adhesive	: Low VOC

## **3. TECHNICAL SPECIFICATIONS**

### **3.1 VRF UNITS**

VRF units are to be incorporated with scroll / twin rotary DC inverter compressor and with DC fan motor. Energy efficiency and quiet operation are very important criteria for the selection of the VRF units. Refrigerant shall be R 410A. The total operation times of all the compressors shall be monitored by a microcomputer, so that there is no unbalance for the operation times of all compressors in the same refrigerant system. Compressors with a shorter operation time are operated with preference. Floor space occupied shall be the lowest possible.

Units shall have microprocessor control panel for ease of operation, self-diagnostics, efficient and precision running. Each indoor unit in VRF system shall have its own microprocessor based controller and shall have corded or cordless remote to operate the unit and set the required room temperature. Unit shall have auto restart facility in case of power failure to avoid operator interference. The unit shall be compatible for operating from remote location through one point centralized controllers.



If one of the compressors in an outdoor unit malfunctions, the other compressors shall take over emergency operation. If one outdoor unit malfunctions in a system, other outdoor units provide emergency operation until repair is affected.

Condenser coil aluminum fins shall have PE treatment for longer life by improving the resistance to corrosion.

Shift and install the outdoor units and indoor units as per the manufacturer's instructions and approved drawings. Outdoor units and indoor units shall be leveled before connecting the copper piping. Refrigerant shall be R410a. Equipment efficiencies shall meet or exceed ASHRAE standard.

VRF ODUs shall be with summer cooling & winter heater model Heat Pump type. VRF system shall have integrator to integrate with BMS system.

All compressors in the ODU shall have inverter. VRF ODUs shall be selected for 50 deg. C ambient temperature and the capacities specified shall be the actual delivered capacity at 50 deg. C.

### **3. 2. COPPER REFRIGERANT PIPING:**

Soft copper piping of 20/21 SWG shall be used for VRF indoor unit connections. All other copper piping shall be hard drawn 18/19 SWG shall be used. Copper piping shall be of VRF grade with 100% eddy current testing. Copper piping shall be supported or clamped at every 1.5mt. distance. Only imported refnet joints from the equipment supplier should be used for VRF piping. All other pipe fittings shall be of approved make drawn with 18/19 G copper piping. Pressure testing of copper piping should be carried out floor wise as per site condition. Final pressure testing should be carried out after completing the entire piping and after connecting to the indoor units and outdoor units. Copper piping shall be tested at 400 PSI for 24 hours. Valves for the maintenance shall be provided at the required places. Proper supports on the first floor shall be provided for copper refrigerant piping at 1.5m interval.

Refrigerant piping inside the building shall be laid in inverted cable tray of 1.6mm thk perforated GI with all fittings. Refrigerant piping on the open areas shall be covered at bottom and top with powder coated GI cable tray to avoid physical damage. Bottom tray shall be perforated and top tray shall be without any perforations. Both trays shall be of 1.6mm thick.

### **3. 3. INSULATION TO REFRIGERANT PIPING:**

19 mm thick Class "O" nitrile rubber with factory laminated glass cloth tube insulation shall be used for VRF copper piping. The density of nitrile rubber insulation shall be 40 to 60 Kg/cu. m. Both the copper refrigerant piping shall be insulated. Insulation shall be finished properly and neatly at all fittings and joints. PVC sleeve shall be provided at all supports and shall be tied firmly with wire tie. Insulation shall not be damaged at supports. PVC sleeves shall be provided over the insulation when passing through the walls or slabs. All joints shall be sealed with self-adhesive tape. Nitrile rubber insulation shall be UV resistant and suitable for outdoor application without any treatment. Thermal conductivity at 0 deg. C shall be 0.033 W/m. deg. K. Water vapor permeability  $\mu$  shall be more than 10,000. Exposed insulation shall be painted with two coats of UV resistant paint.

### **3. 4. COMMUNICATION CABLE AND CONTROL CABLING:**

Communication cable and control cabling: Communication cable and control cabling shall be laid in 20mm dia. FRLS PVC conduits. PVC conduit should be clamped neatly. Cable terminations and dressing shall be done properly and neatly.

### **3. 5. DRAIN PIPING:**

CPVC drain piping shall be used for the drain piping. Proper care shall be taken to lay the drain piping with sufficient slope and should be clamped or supported at 1.5m interval. All drain pipe joints shall be done with adhesive. Drain piping should be tested for leaks before commissioning. Drain piping shall be insulated with 9 mm thick Class "O" nitrile rubber insulation (40 to 60 Kg/cub.mt. density). Insulation shall not be damaged at supports. PVC sleeves shall be provided over the insulation when passing through the walls or slabs. All joints shall be sealed with self-adhesive tape. Nitrile rubber insulation shall be UV resistant and suitable for outdoor application without any treatment. Thermal conductivity at 0 deg. C shall be 0.033 W/m. deg. K. Water vapor permeability u shall be more than 10,000. Exposed insulation shall be glass cloth lamination and painted with two coats of UV resistant paint.

### **3. 6. FLOOR MOUNTED HORIZONTAL AIR HANDLING UNITS (AHUs):**

**Casing:** Double skinned panels shall be made of galvanized steel PUF insulation and shall be fixed to 2.5 mm thick aluminum alloy box section frame work with stainless screws. Aluminum profile shall have thermal break profiles. Panel thickness shall be 48±2 mm thick Outer sheet of panels shall be made of galvanized 0.8 mm thick pre-painted / pre plasticized sheet and inner skin of 0.8 mm thick plain GI sheet.

The casing shall be mounted on an aluminum alloy channel base. The panels shall be sealed to the frame work by 'O' ring gaskets held captive in the framed extrusion. All panels shall be detachable. Inspection door hinges shall be made of die cast aluminum with stainless steel pivots, handles shall be made of hard nylon. Units with various sections shall be suitable for onsite assembly with continuous foam gasket. All fixing screws and gaskets shall be concealed. Units shall have hinged quick opening access door in the fan and filter section.

Bigger AHUs shall have required reinforcement to take care of the static. AHU cabinet should not sag or bend during starting and running.

Fan Section:

Fan Section: Fan section shall comprise of 2 no. direct driven plug fans (1 working + 1 standby). Complete fan assembly shall be individually tested and precision balanced dynamically. Fan & motor shall be mounted on vibration isolators. Fans shall have air tight back draft damper / gravity louvers to avoid short circuiting of air through non working fan. Motors shall run on VFD mode as well S/D connection (above 5Kw), and DOL up to 5Kw.

#### Motor and Drive Set:

Fan motors shall be suitable for 415V + 10%, 50 cycles, 3 phase, AC supply. It shall be squirrel cage, totally enclosed fan cooled and flame proof motors. Motors shall be specially designed for quiet operation and motor speed shall not exceed 1450 RPM. Fan motors shall be mounted inside the AHU on spring mounts with belt drive facility with easy belt tensioning. Drive to fan shall be provided through belt-drive with a standard belt guard housing the bolt and adjustable motor sheave. AHU will have two motors and drive sets installed inside the AHU. Fan will have an extended shaft on both sides suitable to install drive sets on both sides. One motor will be working and one will be stand by. Belts shall be of the oil-resistant type. The frame for mounting the fan and motor shall be isolated from the double skin casing with spring isolators.

**Coil Section:** cooling coil shall be constructed from 12 / 16 mm OD copper tubes 24 gauge wall thickness, mechanically bonded to aluminum fins of 34 / 36 gauge thick and assembled within a heavy gauge galvanized steel frame work. Coils shall be provided with air vent and drain plugs. Coil assembly shall be supported on slide frames for easy withdrawal.

#### Filter Section:

Filter banks shall be easily accessible and designed for easy removal and renewal of filter cells. Pre filters shall be 50mm deep synthetic washable type EN 779: G4 pre filter. Filter frame shall be made of 18 G SS 304.

**Dampers:** Dampers shall be opposed to blade type. Blades shall be made of double

skinned aero foil aluminum extruded sections with integral gasket and assembled with rigid extruded aluminum alloy frame. Manual dampers shall be provided with Bakelite knob of locking the damper blades in positions.

Volume control dampers are to be provided at fresh air, return air, bleed air and supply air provisions. Also fresh air & bleed air damper shall have a pre filter fitted.

**Mixing Box Section:** Mixing box section shall be provided with return air provision and fresh air provision with dampers. Mixing box section shall have pre filters. Mixing box section shall have access doors.

**Fine Filter Section:** Fine filters section shall be at the outlet of the fan. Fine filter section shall have fine filters, provision for connecting the supply duct with a damper. Fine filters section shall have provision to bleed off the air if required. Fine filter section shall have an access door, marine lamp, switch, etc.

Filter banks shall be easily accessible and designed for easy removal and renewal of filter cells. EN 779: F9 fine filter with 300mm deep shall be provided. Filter frame shall be made of 18G GI.

#### Installation:

Floor mounted AHUs shall be installed with continuous loose pedestals in the AHU room. Pedestals shall be two or three depending on the size of the AHU. Minimum two ribbed rubber pads of size 150

x 150 x 12 mm separated by GI sheet shall be provided at 6 or 9 places depends on the size of the AHU. AHUs shall be taken to the respective places and shall be assembled as per manufacturer guide lines.

AHUs placed in open space shall have canopy without any joint to ensure rain water do not fall on the AHUs.

**Testing & Performance:**

Cooling capacity of various unit models shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Flow measuring meters shall be accurately calibrated. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

**3.7 DUCTING:**

**3.7.1. GSS DUCTING WITH MS ANGLE FRAMES:**

GI sheets shall be as per IS 277 – 120 Grade. Fabrication shall be as per SMACNA 2005. Ducting shall be factory fabricated and delivered at site. Thickness of the sheet and type connector shall be as per the following table.

Duct Dimension (mm)	500 Pa	
	Sheet Gauge	Connector
0 - 450	26	TDF
451 - 750	26	TDF
751 - 900	24	TDF
901 - 1000	22	TDF
1001 - 1200	22	Slip-on
1201 - 1300	20	Slip-on
1301 - 1500	20	Slip-on
1501 - 1800	20	Slip-on
1801 - 2100	18	Slip-on
2101 - 2200	18	Slip-on
2201 - 2400	18	Slip-on





2401 - 2700	16	Slip-on
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Duct Dimension (mm)	1000 Pa	
	Sheet Gauge	Connector
0 - 450	24	MS angle frame 40x40x3 mm
451 - 750	24	MS angle frame 40x40x3 mm
751 - 900	22	MS angle frame 40x40x3 mm
901 - 1000	20	MS angle frame 40x40x3 mm
1001 - 1200	20	MS angle frame 40x40x3 mm
1201 - 1300	18	MS angle frame 40x40x6 mm
1301 - 1500	18	MS angle frame 40x40x6 mm
1501 - 1800	18	MS angle frame 40x40x6 mm
1801 - 2100	16	MS angle frame 40x40x6 mm
2101 - 2200	16	MS angle frame 40x40x6 mm
2201 - 2400	16	MS angle frame 40x40x6 mm
2401 - 2700	16	MS angle frame 40x40x6 mm

For GSS ducting, rivets shall be of MS. The distance between the rivets shall not exceed 100mm. The distance between bolt & nuts shall not exceed 100mm.

All bolts, nut & washers shall be of GI. Bolt & nuts shall provide with both sides washers. Good quality self-adhesive rubber gasket with 5 mm thickness shall be used.

Ducting shall be supported on MS pre painted 'L' shaped brackets with required cross bracing for all the ducts which are running along the wall. All the MS supports shall be painted with one coat of red-oxide and two coats of black enamel paint. For hanging ducts supported from true ceiling, GI full threaded rod and slotted angle shall be used as per the following table.

S. No.	Duct Size	Thickness of formed channel	Gauge	Rod dia.	Anchor Fastener
1	Up to 500mm	1.0mm	20	8 mm	M 8
2	501 – 1000mm	1.5 mm	16	8 mm	M 8
3	1001 – 1500mm	2.0mm	14	10 mm	M 10
4	Above 1500mm	3.0mm	14	12 mm	M 12

Anchor fasteners make shall be Hilti / Fischer.

Ducting supports shall be provided at every 2400mm distance. Ducting supports shall be provided on both sides of the wall / partition when it is passing through the wall / partition. Ducting shall not be supported on the wall or false ceiling. Duct support shall not be sagging. Proper care should be taken to avoid duct leakages. Sealant shall be used if required. Vanes in elbows and collar take off shall be provided. Sealant shall be applied to all transverse joints and longitudinal joints for exhaust ducting. Measurements for the ducting shall be taken at center line.

Duct sleeves made of 18 G sheet shall be provided at wall crossings. MS angle frames shall be provided on the both sides and at the middle to take the weight of the wall. The sleeve size shall be 50mm more than duct size. Duct shall be supported on both sides of the wall / sleeve.

Gap between the sleeve and duct shall be filled with fibre glass material tightly around the duct. This needs to be done by HVAC contractor.

On both sides of the wall, fire sealant shall be applied on the surface. This work will be part of civil work / interior work.

Each duct piece shall not be longer than 4' and shall be smaller wherever required as per the drawing and as per the site conditions. Full elbows / partial elbows shall be as required.

Ducting shall be subjected to pressure testing at designed pressure as per SMACNA. Necessary opening of ducts, taking of take offs, providing dummies, etc. shall be done before conducting the duct pressure test.

### **3. 8. DIFFUSER PLENUMS:**

Diffuser plenums shall be factory fabricated with 26 G GI sheet. Plenum shall not have gaps at the corners. Sealant shall be used wherever required. Plenum shall have round connection on the side with groove for connecting with the flexible ducting. Plenum shall have the collar to fix the diffuser. Collar size shall suite with size of the diffuser neck. Collar shall not have any gaps or leaks. Plenum shall have hooks for suspending from the slab. Diffuser plenum shall be installed with two anchor fasteners and chain. Diffuser size shall be 550 x 550 x 450 / 300Ht outer and neck size of 375 x 375 / 450 x 450mm. Inside of the plenums shall be painted with black enamel paint with mat finish.

### **3. 9. ROUND SPIGOT & BUTTERFLY DAMPER:**

Round spigot and butterfly damper shall be fabricated with 20 G GI sheet. Butterfly damper shall have handle for opening and closing. Handle should have the locking arrangement. Open and close positions shall be marking with stickers on the damper. Rubber lining shall be fixed on the inner face of the damper at the blade to avoid any metal to metal contact. Blade shall have smooth edges. Butterfly damper shall be fixed with gasket, bolt and nuts. Duct thermal insulation and acoustic insulation shall finished neatly around the butterfly damper.

### **3. 10. VOLUME CONTROL DAMPERS:**

Volume control dampers shall be made out of 1.2 mm thickness galvanized steel sheet frame with 1 mm thick blade. Blades should be double skinned aero foil construction and opposed blades should be at 50mm pitch centers. The blades should be mounted in nylon bushes operated by an interior wheel gear system. The operating lever or knob shall have locking arrangement and markings of various positions including open and closed position. VCD shall be low leakage type and volume control of 0-100% complete with neoprene rubber gasket, nuts, bolts, screws linkages, flanges etc.,

### **3. 11. GRILLES / DIFFUSERS:**

Grilles shall be linear type made out of heavy extruded aluminium sections. The grilles shall be rectangular linear type for supply and return air. Supply air grilles shall have opposed blade volume control dampers of aluminium construction. All the grilles shall be powder coated with approved colour shade. Teak wood frames treated with anti-termite solution shall be used wherever necessary. Grilles shall have concealed fixing screw. Ducting and all items at the back side of the grilles shall be painted with dull black paint. The discrete grilles will have end flanges. Ends of the continuous grilles shall have end piece with three side flanges. Alignment strips shall be used for proper alignment.

Diffusers shall be square in shape and made out of heavy extruded aluminium sections with removable core and concealed fixing screw. Teak wood frames treated with anti-termite solution shall be provided wherever necessary.

### **3. 12. COLLAR DAMPERS FOR GRILLS / DIFFUSERS / SLOT DIFFUSERS:**

Collar dampers shall be made of Aluminium with nylon geared control & with aero foil blades in black matt powder coated finish. Collar dampers shall be 26G gauge. Opposed blade volume control dampers made out of aluminium extruded sections with nylon geared with aero foil blades & black matt powder coated shall be provided for supply air diffusers.

### **3. 13. LOUVERS:**

Weather proof Louvers shall be made out of extruded aluminium and colour should match with the building finish or as approved by the Owner / Consultant and these shall be of rain protection and metal bird screen to be fitted on the inner surface. The louvers shall have nylon mosquito net. Louvers shall be curved wherever necessary to match with building profile.

### **3. 14. HEPA FILTER MODULE:**

HEPA Module made of with Galvanized Iron sheet duly powder coated with suspension arrangement and provision for grill fixing arrangement. VCD controlled from inside the cleanroom with bevel gear arrangement. Filter loading from inside the cleanroom.

HEPA Filter shall be Hooded Terminal type. HEPA filter shall be of mini pleat type with efficiency of not less than 99.97% down to 0.3 microns EN 1822 standard H13 grade with protection grid on one side. HEPA filter initial pressure drop shall be of 25mmwg at the rated flow. HEPA Filter shall be fixed in a soldered GI box with a flanged frame & facility to have DOP / PAO Test at site. Each filter shall be tested by DOP / PAO method and a certificate/s to the effect that such tests have been conducted shall be furnished by the contractor. The details of the DOP / PAO method adopted by the contractors / manufacturers at their works including those applicable to the aerosol generator, particle counter and the method of testing shall be described fully by the tenderers in their tender. The tenderer shall confirm that they will afford every facility for the owners / consultants or their representatives to observe the manufacturing of filters and witness the tests if they so desire. The owners / consultants reserve the right to stipulate that a leak test be performed on any or all filters on their receipt at site before taking delivery. The tenderers shall specifically confirm that they are agreeable to comply with this requirement. Owners / Consultants will witness the Test of few HEPA filters as desired.

### **3.15. SS GRILL:**

Perforated Grilles made of 20G SS 304 for Supply air outlet at HEPA terminal with pressure plate arrangement along with all accessories to be provided. For Return Air Riser inlet complete with provision for fixing / holding the Pre-Filter (EN 779: G4) with magnetic arrangement shall be provided.

### **3.16. FLEXIBLE DUCTING:**

The insulated flexible duct shall have inner core made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Fiberglass insulation of minimum 14 kg./cub.mt. density having a R-value  $4.2^{\circ}\text{F}\cdot\text{Ft}^2\cdot\text{hr}/\text{btu}$  and 25mm thk shall be wrapped over the inner core and covered with stronger outer jacket cum vapor barrier made of fiberglass reinforced metalized

polyester film laminate. The insulated flexible duct should be fire retardant type. Limit Flexible Duct to not more than 3ft Length for each connection. Flexible duct shall be properly supported to avoid touching other services with anchor fasteners, full threaded rod, GI clamps, etc. Proper care shall be taken to ensure the flexible duct is not damaged due to supports and due to touching other services.

### **3. 17. THERMAL INSULATION OF DUCT**

Thermal insulation of the ducting shall be done with aluminium foil laminated 25/19 mm thick class "O" closed cell, chemically cross-linked polyethylene foam XLPE offering high performance in terms of flame retardant protection in the event of fire, plus long lasting constant thermal performance having a 'K' value of 0.037 W/mK at a mean temperature of 20°C and a minimum density of 40 Kg./Cu.mtr.

The insulation materials shall be fixed to the ducting with adhesive. All duct angle joints shall be covered with 6 inch wide insulation. All insulation joints shall be sealed with 50mm wide self-adhesive aluminium tape. Adhesive shall be of Low VOC adhesive. Necessary test certificates shall be submitted. Thermal insulation shall be cut to the required size with sharp knife. Insulation edges shall be straight. Thermal insulation shall be applied without excessive pressure on the insulation. Insulation shall be finished properly around the branch tapings, collars, etc.,

All exposed ducting shall be insulated with class "O" XLPE of thickness 25mm thick for supply & 19mm thick for return ducts (40kg/m<sup>3</sup> density) running in non-air conditioned areas and outside the building. The insulation shall be finished with polythene paper and 24G chicken wire mesh and finished with 24G aluminium cladding.

### **3.18. STRIP HEATERS:**

Strip heaters shall be installed in the duct with control & wiring to maintain the RH within +/- 5% and temperature within +/- 1 deg.C. Strip heaters to be accommodated in the Supply air duct. Control panel shall have isolators, safety thermostat, 2-stage humidistat for switching ON the heaters in 2-stages, air flow switch, etc. Heater bank shall be suitable for integration to controller for monitoring and operation. Shall be allowed to operate manually also. Shall be suitable for outdoor installation

### **3.19. AHU PLENUMS:**

Double skin plenums shall be factory fabricated 0.6 mm GI powder coated outer skin, 25 mm thick PUF insulation, 0.6 mm GI inner skin, aluminum extrusions, etc. PUF shall be injected in to the panels. Panels shall fixed to the aluminum extrusions with gasket. Density of PUF insulation shall be 36 Kg. /cub. mt. The construction of the plenum shall be similar to AHU. Necessary cutouts with GI collar shall be provided for duct connection and fan connection. Plenums shall be installed using GI full threaded rods of 12 mm dia rods, anchor fasteners and MS Channel. All the supports shall be painted with one coat of red oxide paint and two coats of black enamel paint.

### **3.20. VARIABLE FREQUENCY DRIVES:**

Drive shall be dedicated HVAC drive designed for variable torque. The frequency drive shall employ sine wave pulse width modulation control and shall be suitable for operation on a three phase, 415 Volts, 50 Hertz input supply with an input voltage variation of +10% and -15% and frequency variation of  $\pm 1$  Hertz. The drive shall be capable of providing a variable frequency output of 0 to 50 Hertz proportional to a 4 to 20 mA or 0 to 10V input signal obtained from a field sensor/transmitter. Adequate

Ventilation shall be ensured for continuous operation at the maximum ambient temperature specified by the manufacturer. Drives shall be capable of operating in

Ambient temperatures of 45 deg. C without any derating. Display shall be graphical, alphanumeric, 6 line and back lit. Drive shall have two level password protection for read & write to prevent unauthorized access. All power, control and instrument cabling shall be provided and installed as described elsewhere in this specification. Drives shall have Modbus RTU / Bacnet IP for integrating with third part BMS. VFDs shall have harmonic filters, RFI filters and shall have energy (kW-hr) measurement.

VFDs for pumps, cooling tower, AHUs, etc. shall have harmonic filters and RFI filters to eliminate harmonics.

### **3.21. ACCESS DOORS / PANELS IN THE DUCTING:**

Access doors shall be factory fabricated or manufactured and should double skin with 22 G GI sheet. Thickness shall be 25 mm thick 25mm thick 48 Kg/cub. mt density fibre glass insulation or PUS insulation shall be provided between inner skin and outer skin. Access doors shall be supplied with required frame made of 22 G GI sheet. Frame shall be provided with 3 mm thick Neoprene gasket to avoid air leakage. Access door should have 4 no. cam locks on four sides and shall have handle for easy removal and fixing. It should have tapered locking system. Size of the access door shall be as mentioned in the BOQ. Access door frame, shall be fixed to the duct and access door shall be placed in the frame and to be locked.

### **3.22. CABINET FAN:**

Double skinned panels shall be made of galvanized steel with 40mm thick PUF insulation and shall be fixed to 2.5 mm thick aluminium alloy normal / thermal break profiles frame work with stainless steel screws. Outer sheet of panels shall be made of galvanized 0.8 mm thick pre-painted / pre-plasticized sheet and inner of 0.8 mm GSS. Aluminium profiles shall be internal round corners to avoid accumulation of dust.

The casing shall be mounted on an aluminium alloy channel base. The panels shall be sealed to the frame work by 'O' ring gaskets held captive in the framed extrusion. All panels shall be detachable. Inspection door hinges shall be made of die cast aluminium with stainless steel pivots, handles shall be made of hard nylon. Units with various sections shall be suitable for onsite assembly with continuous foam gasket. All fixing screws and gaskets shall be concealed. Units shall have hinged quick opening access door in the fan and filter section.



Fan shall be EC fan with an extra standby fan. Exhaust air fan shall have EN 779: G4 pre filter. Fan shall be provided with outlet cowl bird screen. Exhaust fan shall have built in plenum for terminating the ducting. Fans shall have outlet damper. Fans shall be installed with ribbed rubber pads for vibration isolation.

**3.23. MINIMUM PERFORMANCE PARAMETERS OF VARIOUS EQUIPMENT:**

All equipment efficiencies shall meet or exceed the efficiencies stipulated by ASHRAE 90.1.

**3.24. ADHESIVES:**

All adhesives used shall be of low VOC type and technical data sheets shall be submitted for approval before using. Necessary test certificates and documentation shall be provided for the adhesives.

**3.25. MOTORS:**

All motors used for pumps, ventilation units, TFAs, etc. shall be of high efficiency motors.

**3.26. FLUSH OUT:**

All air conditioned areas are to be flushed out before occupation. AHUs and temporary fans if required to be installed during flush out. Flush out documentation shall be prepared and to be submitted.

**3.27. BMS PROVISIONS:**

All the provisions required in the VRF system, ducting and electrical panels for BMS integration shall be provided by HVAC vendor.

**3.28. TEST CERTIFICATES AND CALIBRATION CERTIFICATES:**

Test certificates shall be submitted for all materials, equipment, filters, etc. All instruments, gauges, etc. shall have valid calibration certificates.

**3.29. DOCUMENTATION:**

Colour drawings of scheme and layout in the appropriate size shall be laminated / framed and shall be displayed in the Plant room, AHU Room, Air conditioned area, etc. as per the instructions of Engineer – In - Charge.

**3.30. IDENTIFICATION OF SERVICES AND EQUIPMENT:**

For pipe work services & its insulation the colors of the bands shall comply with BS 1710: 1971. For duct work & its insulation the colors of the triangles shall comply with BS 1710: 1971.

All equipment, Panels, HEPA filter modules, Supply Air Diffusers / Grilles, Return Air Diffusers, etc. shall be numbered for proper identification. The tag numbers shall be stickered / painted on the equipment and same numbers shall be referred to as built drawings / documents.

### **3.31. FILTERS:**

Filters shall be provided as per the BOQ and specifications.

### **3.32. COMMISSIONING FILTERS:**

All the air handling units shall be installed with commissioning filters. After commissioning and initial phase of operation, the commissioning filters shall be replaced with permanent filters. The cost of the equipment / items shall include the cost of commissioning filters. Commissioning filters shall include EN 779: G4 pre filters.

### **3.33. ELECTRICAL WORKS:**

#### **3.33.1. SCOPE:**

The scope of work in HVAC contractor includes the following:

Supply, installation, testing and commissioning of the items such as plant room HVAC panel, AHU distribution panels, starter panels, isolators, cables, earthing etc., as detailed in the BOQ. It shall be the responsibility of the HVAC contractor to incorporate all necessary safety and protection interlocks etc., required for protection and reliable operation of the equipment covered in his scope of supply. The overall responsibility of providing the guaranteed performance of A.C system in conjunction with above electrical system shall rest with the HVAC contractor. The scope also includes visit to the factory/supplier's works, where above electrical items are being manufactured for inspection/testing. Making inspection reports, pointing out defects, deficiencies etc., Safe storage and insurance till handing over the completed installation shall be the responsibility of the AC contractor.

Supply, installation, testing and commissioning of the control cables from the field components e. g. thermostats, humidistat, pressure cutouts, flow level sensing devices and other control/protection components provided by him up to the MCC/Panels terminal block including carrying out termination etc., Supplying & installation of cable trays etc. as they required to meet the best engineering practice for such type of works.

Supply, installation, testing and commissioning of chiller / compressor integral local control console panel. (This normally is an integral part of the chilling plant and is indicated here to clarify the scope of the contractor).

#### **3.33.2. MAIN PANEL:**

The plant room MCC shall comprise of out goings for chillers, pumps, cooling towers, ventilation fans, etc. The main in-comer along with ACB shall also be provided. The bus bar shall be electric grade aluminium. The main panel shall be fabricated out of MS sheet on angle frame work and shall be treated with seven tank process before finally painting it with the enamel coat of approved color. The



medium voltage motor control center shall generally conform to IS: 8623 -1993 and shall be suitable for operating under conditions indicated in design criteria.

### **3.33.3. MECHANICAL DETAILS:**

Motor Control Centre shall be dust, damp and vermin proof, sheet steel enclosure with IP-54 degree of protection as per IS: 13947-1993 floor mounted, self-standing type with single front non-draw out compartmentalized design, sheet steel of 2 mm thick shall be used for load bearing members except for back covers and partitions where it may be 1.6 mm. The MCC shall be extendable at both ends.

A base channel/frame of min. 75 mm height and 2.5 mm thickness shall be provided at the bottom.

MCC shall be divided into panels, each consists of: -

- i. Horizontal chamber at top for power and control bus bars.
- ii. Individual feeder modules arranged in multi-tier formation.
- iii. Vertical cable alley to permit cable entry to each module.
- iv. Vertical bus bars (droppers) to feed feeder modules.
- v. Horizontal cable chamber at bottom (min 250mm above the base channel).

All wiring shall be from front. All components shall, except bus bars, be accessible and capable of being removed from front only. Each compartment and vertical cable alley shall have individual sheet steel hinged door with concealed hinges at the front. The compartment door and cable alley door shall be designed to open in opposite directions.

Top bus bar chamber shall have screwed covers at the front and top. Bottom cable chamber shall have cover at the front. Horizontal chamber at top and bottom shall run throughout the length of MCC. Durable resilient neoprene gaskets shall be provided for all doors, covers, cutouts and for all partitions between adjacent units. MCC shall be suitable for cable entry from top. Removable undrilled gland plates shall be provided at the top of the MCC. Double compression type cable glands of required number/type shall be supplied along with MCC.

The MCC shall have uniform height and uniform depth throughout its length. Maximum height of MCC shall be 2400mm. Width of each panel shall be not less than 800mm with cable alley of 300mm:

vi.	Minimum compartment size	:	300mm.
vii.	Maximum operating height	:	< 1900mm
viii.	Minimum operating height	:	> 400mm
ix.	Shipping length	:	Limited to 2500mm.

The colour shall be Tata grey as per IS: 631. All live parts shall be suitable shrouded.

### **3.33.4. FEEDER UNITS:**

The design shall be of non-draw-out type. Each feeder shall be provided with MCCB/MPCB, Contactor, thermal O/L relay, START/STOP Push Buttons, Test Push Button, Local/Remote Selector switch, indicating lamps for On/Off/trip, control circuit MCB and Ammeter. For the purpose of standardization like components in the MCC shall be identical and inter-changeable. All elements of functional unit shall be accommodated in one compartment. Only MCCB operating handle, ON/OFF

push buttons and O/L reset buttons shall be available for operation when the door is closed. Test push button shall be accessible only after opening the door.

The door shall be interlocked with the associated MCCB so that the door can be opened only when the switch is OFF and the MCCB cannot be switched ON when the door is open. The MCCB's shall have provision for Pad locking in the OFF position. The compartments shall have nameplate to designate the feeder.

### **3.33.5. BUS BARS:**

MCC shall be provided with 4 power bus bars for 3 phase and neutral and 2 control bus bars at the top in a separate compartment. Bus bar arrangement shall generally conform to IS: 375-1963. The bus bars shall run continuously throughout the length of the MCC. Bus bars shall be rated for 1.5 times the ratings of the incoming breaker. Permissible current density shall be 0.6 mA/Sq. mm. for Al.

Both horizontal and vertical bus bars shall be of EC grade Aluminium alloy equivalent to E 63401-WP (E91E) as per IS: 5082-1981. The power bus bars shall have a short-circuit withstand capacity of 50 KA rms for 1 sec and dynamic withstand capacity of 105 KA peak. The control bus bars shall be of high conductivity electrolytic grade copper as per IS: 613-1984.

The bus bar shall be phase identified by colours Red, Yellow and Blue for phases, black for neutral. The bus bars shall be rated for 40 Deg C temp rise over an ambient of 45 Deg. C. Cross section of bus bars shall be uniform throughout. The bus bars shall be supported on tough, non-hygroscopic, self-extinguishing fire retardant insulators with ribbed construction to prevent tracking due to dust accumulation and to have larger

creep age distance. Bus bars and supports shall withstand maximum stresses due to the short circuit current specified. The clearance between bare phase power bus bars and between phase and earth bus bars in air shall not be less than 50mm. All bus bar joints shall be bolted type, Belleville/spring washers shall be used for joints to prevent loosening of nuts and overheating.

### **3.33.6. INCOMER:**

The incomer ACB / MCCB shall be of suitable capacity, 3 pole and neutral arrangement along with voltmeter and CT operated ammeter, indication lamps etc. The MCCB shall have the following features:

- Suitable for operation to 415 V, 3 Phase, 4 wire system.
- Air break, triple pole, conforming to IS: 13947-2-1993.
- Suitably derated for 50 deg C ambient to cater to load.
- Quick make and quick break, manually operated, trip free switching mechanism non-draw out type.
- Adjustable magnetic releases.
- Breaking capacity: 50 kA.
- Clearly identifiable handle position for ON, OFF and trip.
- 2 NO & 2 NC auxiliary contacts wired up to the terminals.
- Long operating handles to be provided for operation of the MCCB.

Incomer module shall also have: -

- One no. Voltmeter (0-500 V) with 4 position selector switch and back up fuses.
- One no. Ammeter (Taut band) as shown in the SLD with 4 position selector switch and back up fuses.

### 3.33.7. OUTGOING FEEDERS:

MCCB/MPCB shall be provided for all the outgoing feeders of the MCC, as per drawing suitable for motor back up protection and shall have following features:

- Capable of providing protection, coordination in conjunction with suitably rated contactor and over load relay.
- Conform to IS: 13947 (Part-2), 1993.
- Quick make, quick break, trip free mechanism.
- Breaking capacity, 50 KA
- Push to trip facility.

#### Contactors

- Contactors shall be 3 poles, air break type rated for AC 3 duty.
- Minimum rating of contactor shall be 150% of the motor current.
- Contactor shall have 2 NO + 2 NC auxiliary contacts.

#### Over load relays:

- The thermal O/L relays shall be three element bi-metallic type, manually reset. The reset button shall be available for operation when the door is closed.
- O/L relays shall be directly connected to the contactor.
- O/L relay shall be selected to suit starting time of the drive.
- Relay shall be provided with 1NO + 1NC contact.

### 3.33.8. INDICATING INSTRUMENTS:

#### Ammeters:

- Shall be with Class 1.5 accuracy, 96 mm x 96 mm taut band for all outgoing.
- A red mark shall be provided on the ammeter dial corresponding to full load current of motor.
- Shall have suppressed O/L range (cramped end scale) beyond full load current to read starting current of 600 to 800% of full load current of motor.
- The ammeter shall be provided for all motors and shall be CT operated.

#### Volt meter:

- A taut band voltmeter, 0-500V AC range, 96 mm x 96 mm size for incomer and 96 mm x 96 mm for outgoing along with selector switch and control fuses shall be provided. Incomer panel shall have a voltmeter of 0-250V AC range for control supply voltage. Voltmeter shall be industrial Grade B accuracy and shall have suppressed scale for the lower range.

Selector switches shall have 3-way and off position with black colour knob.

Indicating lamps: All indicating lamps shall be Red, Green and Amber colour lenses as required shall be provided. Red for ON and green for OFF and amber for Tripped on over load.

Digital energy meters shall have the provision to display and record demand (KW), energy (KW-hr), THD, total power factor, voltage and current in each phase. Energy meters shall have RS485 port to integrate with third party BMS.

### **3.33.9. ELECTRICAL RATINGS OF THE VARIOUS EQUIPMENT:**

The KW ratings of various equipment shown in the electrical SLD is tentative and may change based on the equipment selection. Hence vendor shall consider the electrical ratings of various equipment being offered by him. Tentative HVAC Electrical Loads are given in Attachment 2.

### **3.34. CABLING AND EARTHING:**

All cables will be of copper / aluminium conductor conforming to IS 1554. They shall be of 1.1 KV grade XLPE insulated armoured cables. Cables shall be laid as per IS code of practice. The earthing shall be of GI flat / wire as per suitable rating and sizes. All the motors & panels shall be double earthed.

Over load relays:

- The thermal O/L relays shall be three element bi-metallic type, manually reset. The reset button shall be available for operation when the door is closed.
- O/L relays shall be directly connected to the contactor.
- O/L relay shall be selected to suit starting time of the drive.
- Relay shall be provided with 1NO+1NC contact.

Current transformers: CTs shall be with bar primary, cast resin type. Measuring accuracy shall be Class 1VA rating not less than 15.

Push buttons: Push buttons shall be heavy duty type with 1NO + 1NC contact rated for 10 Amps. The colour code shall be green, red and black for 'Start', 'Stop' and 'Test' respectively.

Type of starters shall be as under:

7.5 HP and above	-	Star Delta
Below 7.5 HP	-	DOL

### **3.35. CONTROL CABLING:**

Control cabling shall be laid in PVC / GI conduits of required size. Conduits should be clamped neatly. Cable terminations and dressing shall be done properly and neatly.

### **3.36. WIRING AND TERMINATIONS:**

MCC shall be completely factory assembled and wired.

Power connection shall be done by 660/1100 V grade single core PVC insulated copper conductor of min. cross section 4.0 Sq. mm. and control wiring shall be 650 V/1100 V PVC stranded single core copper conductor of minimum cross section 1.5 Sq.mm.

Each wire shall be identified by ferrules at each end in accordance with the schematics.

Wiring to the door shall be done by flexible cable and the cables shall be bunched, sleeved and cleated so that no mechanical damage can occur to the cables while opening/closing the door.

Not more than 2 wires shall be terminated at one control terminal to suit individual feeder requirements. All terminations shall be of adequate current rating and size to suit individual feeder requirements.

Outgoing power terminations shall be designed for connecting PVC / XLPE aluminium cables. Suitable provision shall be made for termination higher size cables.

Each control terminal block shall have 20% spare terminals. Inter module wiring in the same panel shall be through vertical cable alley. Inter panel wiring shall be through horizontal cable chamber at bottom. Separate terminal blocks shall be provided for power and control cables.

### **3. 37. APPLICATION OF FIRE SEALANT AROUND THE HVAC SERVICES:**

All gaps around the fire dampers, ducts, pipes, etc. when these are passing through the fire compartment / fire rated wall, this procedure shall be followed. All the gaps around the services shall be filled tightly with rock wool / glass wool having service temperature of minimum 700 deg. C. Fire sealant shall be applied on both sides with minimum 12mm thick Method shall be submitted and get it approved.

The measurement for fire sealing will be taken on one side of the wall, the area covered with fire sealant. The measurement will not be taken on both side of the wall and shall not be dependent on wall thickness.



#### **4. STANDARDS**

1. SMACNA-2005: HVAC System Duct
2. IS: 659 - Safety Code for A/C System
3. IS: 1239 Part I – MS Tubes & Pipes
4. IS: 1239 Part II – Pipe Fittings
5. IS: 3589 – MS pipes
6. IS: 6392 – Pipe Flanges
7. IS: 4894 – Centrifugal Fan
8. IS: 5312 – Check Valves
9. IS: 8183 – Thermal Insulation Mineral Wool
10. IS: 325 - 3 phase induction motor
11. IS: 277 - Galvanized steel sheet (plain& corrugated) wire for fencing
12. IS: 2379 - Colour code for identification of pipe lines
13. IS: 3103 - Code of Practice for industrial Ventilation
14. BS: EN: 779 – Filters
15. ASHRAE Standards for Health Care
16. Carrier System Design Manual
17. JCI Standard for Hospitals.
18. ISO 14644 Cleanroom classification standards.

## **5. MEASUREMENTS METHODOLOGY**

Mode of Measurement for payment of items of ducting and piping & their insulation shall be as follows:

### **5.1. DUCTING:**

Payment for ducting shall be on the basis of the external surface area of the ducting including all material and labour for installed duct. The Rate/SM of the external surface shall include all wastages, iron angle flanges, gaskets for joints, bolts and nuts, duct supports and hanger vibration isolation pads or suspenders, flexible connections, inspection doors, running vanes, straight vanes, stiffeners and any item which will be required to complete the external insulation and acoustic lining. The external area shall be calculated by measuring the overall width and depth (including the corner joints) in the center of the duct section from flange face to flange face in case of ducts length with uniform cross section. Total area will be arrived by adding up the area of all duct sections. In case of taper pieces average width and depth will be worked out as follows:

W 1 = Width of small cross section

W 2 = Width of large cross section

D 1 = Depth of small cross section

D 2 = Depth of large cross section

$$\text{Average Width} = \frac{W 1 + W 2}{2} \quad \& \quad \text{Average Depth} = \frac{D 1 + D 2}{2}$$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections flatted with angle iron flanges, otherwise at the bottom of the flange where the flanges are of duct sheet. For circular pieces the diameter of the section midway between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface area of the taper piece. Duct measurements for calculation of area shall be taken before applications of insulation. For the special pieces like bends, branches and tees etc., same principles of area measurements as for liner shall apply along the center line of duct fitting.

### **5.2. PIPING:**

Shall be measured in units of length along the center line of installed pipes including all pipe fittings, flanges (with gaskets and nuts and bolts for joining), 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 centerline of installed pipes and no special rates for these accessories shall be permitted. The quoted unit rates for center line linear measurement of piping shall include all wastage, allowances, pipe supports includes hangers, MS channel, wooden bunches, nuts and check nuts, vibration isolator suspension where specified or required, and cost of excavation, bedding back filling and finishing as required to complete the piping installation as per the specification. None of these items will be separately measured and paid for. However, all valves (gate/ globe/butterfly/check -balancing/purge/drain etc.), strainers, orifice plates, temperature gauge, pressure gauges shall be separately measured 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. The cost shall also include any excavations and making masonry valve chamber with steel cover etc.,

### **5.3. PIPE INSULATION:**

Shall be measured in units of length along the centerline of the installed pipe, strictly on the same basis as the piping measurements described above. It may be noted that for piping measurements, all valves, orifice plates and strainers are separately measurable and their quoted unit rates shall include the insulation cost in the valve required and as specified.

### **5.4. DUCT THERMAL / ACOUSTIC / UNDERDECK INSULATION:**

This item is provided separately for various thicknesses and shall be paid for an area basis of un-insulated duct. The area of the duct to be insulated shall be measured before application of insulation. The Under deck insulation shall also be paid on the basis of the area to be covered. This includes the measurement of beam circumference to be insulated.

### **5.5. DIFFUSERS, GRILLES AND DAMPERS:**

These shall be measured on the basis of physical dimensions of the damper and grilles installed at site. The physical measurement shall exclude the flanges on all sides and would be based on the neck size of the grilles / diffusers. Measurement for dampers shall be based on inner to inner dimension after excluding flanges on all sides. Measurement of grilles and diffusers shall be done based on the neck size.

### **5.6. HEPA FILTER MODULES:**

These shall be measured on the basis of counting of the modules based on the physical measurement of given dimension on the neck size of installed unit at site. Measurement for dampers shall be based on inner to inner dimension after excluding flanges on all sides.

## **6. TESTING PROCEDURE AT SITE**

### **6.1. GENERAL:**

The Contractor must perform all inspections and tests of the system as a whole and of components individually as required, under the supervision of the Engineer, in accordance with the provisions of the applicable 'ASHRAE' standards or approved equal and as per site requirements. All tests shall be recorded in the format approved by Consultant/Owner.

### **6.2. PIPING SYSTEM:**

In general pressure tests shall be applied to piping only before connection of equipment and appliances. In no case shall piping, equipment appliances be subjected to pressures exceeding their test ratings. Tests shall be completed and approved before insulation is applied. After tests have been completed, the system shall be drained and cleared of all dust and foreign material. All strainers,



valves and fittings shall be cleaned of all dirt, fillings and debris. All water piping shall be tested and proven tight under hydrostatic pressure of 10 Kg/Sq cm, unless stated otherwise in the specifications. The prescribed pressure shall be maintained at least three complete days of 24 hours each.

Refrigerant piping shall be pressure tested as per original equipment manufacturer recommendations.

### **6.3. DUCT WORK:**

All branches and outlets shall be tested for air quantity, and the total of the air quantities shall be within plus three percent (3%) of fan capacity. Fire dampers, volume control dampers and splitter dampers shall be tested for proper operation. Duct work shall be subjected to smoke testing before applying the insulation. All the leaks shall be arrested with sealant.

### **6.4. BALANCING AND ADJUSTMENT:**

All air handling/ventilation equipment, ductwork and outlets shall be adjusted and balanced to deliver the specified air quantities indicated, at each inlet and outlet. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available Horsepower, the Engineer shall be notified before proceeding with the necessary rectification and balancing of air distribution system. All grilles and diffusers shall be balanced for air quantities using digital hood anemometer with hood. Hood anemometer shall give direct reading of air quantity.

Water circulating system shall be balanced for required water quantities at various equipment such as pumps, chillers, air handling units, and cooling tower etc. using balancing valves (Manual/Automatic).

Pump impellers shall be trimmed as required after commissioning to match the system static with the pump static without throttling the valves. This is to ensure pumps are not over loaded and running efficiently.

### **6.5. ELECTRICAL EQUIPMENT:**

All electrical equipment shall be cleaned and adjusted at site before connection of power. The contractor as per relevant IS/IE rules shall carry out the following minimum tests:

- Wire and Cable continuity tests.
- Insulation resistance test between phase to phase, phase to earth and phase to neutral on all circuits and equipment, using a 1000volt Megger.
- The earth resistance between conduit system and earth must not exceed half (0.5) ohm.
- The phase rotation tests.
- Operating tests on all protective relays to prove their correct operation before energizing the main equipment including secondary injection test at site.
- Operating tests on all starters, circuit breakers etc.,

### **6.6. PERFORMANCE TESTS:**

The installation as a whole shall be balanced and tested upon completion and all relevant information shall be submitted to the owner. Electrical current reading in Amperes of full and average load running and starting together with name plate, current in each electrical motor. Daily records should be

maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream 'ON-COIL' of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine. Any other reading shall be taken which the Engineer may subsequently specify.

#### **6.7. ACCEPTANCE TEST AND SEASONAL TESTS:**

After completing all installation works, commissioning, water balancing and air balancing, acceptance test shall be conducted for 24 hours recording temperature, humidity, equipment inlet & outlet conditions, power consumption readings, etc. Necessary schedule with test formats shall be submitted for approval before starting the test.

Seasonal test shall be done for 24 hours during warranty period when peak summer and peak monsoon occurs recording all the above readings.

The above tests shall be repeated if major abnormality is observed during the tests in achieving the conditions or functioning of equipment.

Sufficient manpower with tools and tackles shall be arranged for successful completion of the above tests. Necessary data loggers shall be used during the tests for recording various readings.

#### **Tests:**

Certification shall be defined as the completion of measurements and the preparation of a summary report detailing the operation condition of the cleanroom.

For ISO class 7, following tests should be carried out, preferably in the order given.

- Air supply and extract quantities (Air flow volume determination).
- Air movement control between areas (Room pressurization measurement).
- Air movement control within the room (Air Balancing Test).
- Filter installation leakage test (DOP Test).
- Air borne particles.
- Lighting level measurement.
- Sound pressure level measurement.
- Uniformity measurement of temperature and relative humidity.
- Recovery test.



- Floor to ground resistance measurements.
- Wall to ground resistance measurements.

Any adjustments / rectifications / replacements required during the certification process shall be carried out by the contractor.

All the tests shall be done in accordance with the ISO standards and certification results shall be submitted in ISO formats.

All the instruments used for certification shall have calibration certificates. Calibration of all equipment should be traceable to nationally recognized standards within the previous twelve months or according to the recommendations of the equipment manufacturer. Calibration certificates shall be submitted to client before starting the tests.

Certification shall not be started unless all the works completed in the cleanroom.

Air conditioning system, lightings, etc. shall be fully commissioned and established before starting the certification tests.

Certification test shall be done in the presence of client representative.

**7. LIST OF APPROVED MAKES**

SL. NO.	ITEM	APPROVED MAKES
1	VRF units and Remotes	Toshiba / Mitsubishi Electric / Blue Star / Equivalent Approved
2	Hi wall split units / cassette units - Individual	Daikin / Toshiba / Mitsubishi Electric / Blue Star / Hitachi
3	Refnet Joints	Daikin / Toshiba / Mitsubishi Electric / Blue Star / Hitachi
4	Copper piping	Mandev / Rajco / Maxwell - VRF Grade with 100% eddy current testing
5	Drain Piping - CPVC	Sudhakar / Supreme / Astral
6	Communication Cable / Power Cable	Universal / Finolex / CCI / Polycab
7	Air Handling Units	Stulz / Flaktwood / Systemair / VTS / Zeco / Edgetech
8	Fans for AHUs and Ventilation Units / SISW Fans	Kruger / Nicotra / Systemair / Dyna Air
9	Cabinet fans	Edge Tech / Zeco / Systemair / Dyna Air / VTS
10	Motors	ABB / Crompton / GEC / Siemens
11	Round Inline fans	Kruger / Nicotra / Systemair / Dyna Air
12	Cabinet Inline fans	Edge Tech / Zeco / Systemair / Dyna Air
13	Variable Frequency Drives	Danfoss / ABB / Schneider
14	Factory Fabricated Ducting	Radiant / Harshavardhan / Ducto Fab / Helical Tubes / Spiral Tubes
15	GI Sheets	SAIL / Jindal / Tata
16	Glass wool / Fibre Glass	UP Twiga / Kimmco / K Flex
17	Grilles / Diffusers / Louvers / Toilet exhaust valves	Airmaster / Dynacraft / System Air / Cosmos



18	Flexible Ducting	Atco / Sevenstar / UP Twiga
19	AHU plenums, diffuser plenums and round butterfly dampers, Cross talk attenuators	Sri fab / Sagar air / Radiant / Airmaster / Systemair / Harshavardhan / Spiral Tubes / Ducto Fab / Helical Tubes
20	Fire Dampers – UL Listed & Stamped Class 1	Greenheck / Ruskin Titus
21	Nitrile Rubber Insulation	Armacell / K Flex / Alp Aeroflex
22	Anchor Fasteners	Shakti / Fischier / Hilti
23	MERV Filters	Spectrum / Camfil / Pyramid / EMW / AAF
24	UVGI System	Ruks / Aeropure / Alfaa UV
25	EC Fans	EBM Past / ZeihlAbegg
26	Drain Pumps	Aspen
27	Air Flow Limiters	Trox / Systemair / Mapro
28	Fan Filter Units	Camfil / AAF
29	Volume Control Dampers	Airmaster / Systemair / Cosmos / Dynacraft
30	Electrical Switchgear	Siemens / Schneider / L&T / ABB
31	Vibration Isolators	Dunlop / Resistoflex / Cori
32	PROGRAMMABLE & APPLICATION SPECIFIC CONTROLLER (DDC)	Johnson/ Siemens/ Honeywell/ Sauter/ Schneider
33	Sensors	Johnson/ Siemens/ Honeywell/ Sauter/ Schneider/ Omicron /Radix/ Greystone



**SECTION-VI**

**ANNEXURES**

**ANNEXURE I**

**FORM OF PERFORMANCE GUARANTEE (BY BANK GUARANTEE)**

1. In consideration of the TIFR-Hyderabad, Hyderabad having agreed under the terms and conditions of Letter of Intent / Agreement No..... dated..... made between and..... (Here in after..... called "the said Contractor{s}") .for the work ..... (Here in after called "the said Letter of Intent / Agreement") having agreed to production of a irrevocable bank Guarantee for Rs..... (Rupees ..... only), as a security / guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement, we .....(Indicate the name of the Bank) (hereinafter referred to as "the Bank") Here by undertake to pay to TIFR an amount not exceeding Rs. .... (Rs only) on demand by TIFR.
2. We..... (indicate the name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from TIFR stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs..... (Rupees..... only).
3. We, the said bank, further undertake to pay to TIFR any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.
4. We (indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of TIFR under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-charge on behalf of the TIFR certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We (indicate the name of Bank) further agree with TIFR that TIFR shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by TIFR against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of TIFR or any indulgence by TIFR to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).
7. We,..... (indicate the name of Bank) lastly undertake not to revoke this guarantee except with the previous consent of TIFR in writing.
8. This guarantee shall be valid up to ....., unless extended on demand. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs (Rupees ..... only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Signed and sealed

Dated the ..... day of..... for..... (indicate the name of Bank)

\*(Note: The Letter of Intent shall form part of the Agreement)



**ANNEXURE II**

**UNDERTAKING BY THE TENDERER**

I / We have read and examined the Tender document including terms & conditions, specifications, Schedule of quantities, drawings and designs, general rules & directions, General Conditions of Contract, Special Conditions of Contract and all relevant other documents, publications and rules referred to in the Conditions of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for execution of the work specified for the TIFR-Hyderabad, Hyderabad within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for seventy five (75) days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of Rs..... has been deposited in cash / receipt treasury challan / deposit at call receipt of scheduled bank / fixed deposit receipt of scheduled bank / demand draft of a scheduled bank / Bank Guarantee issued by a Scheduled Bank as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said TIFR-Hyderabad, Hyderabad or its authorized officer shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that the TIFR-Hyderabad, Hyderabad shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by TIFR- Hyderabad, Hyderabad towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein.

Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / We shall treat the tender documents, drawings and other records connected with the work as secret / confidential documents and shall not communicate information derived there-from to any person other than a person to whom I / We am / are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Seal & Signature of Contractor Postal Address

Dated

Witness

Address Occupation



**ANNEXURE-III**

**CERTIFICATE OF LOCAL CONTENT**

**\*We [name of manufacturer] hereby confirm in respect of quoted item(s) that local Content is equal to or more than 50% and come under ‘Class-I Local Supplier’ Category. As being ‘Class-I Local Supplier’, we are eligible for Purchase Preference under ‘Make in India’ Policy vide Gol Order No.P-45021/2/2017-PP (B.E.-II) dated 15.06.2017 (subsequently revised vide orders dated 28.05.2018, 29.05.2019 and 04.06.2020)**

**OR**

**\*We [name of manufacturer] hereby confirm in respect of quoted items(s) that Local Content is more than 20% but less than 50% and come under ‘Class-II Local Supplier’ Category.**

The details of the location (s) at which the local value addition made is / are under:

1. ....
2. ....

Date:

Seal & Signature of the Bidder

**NOTE:**

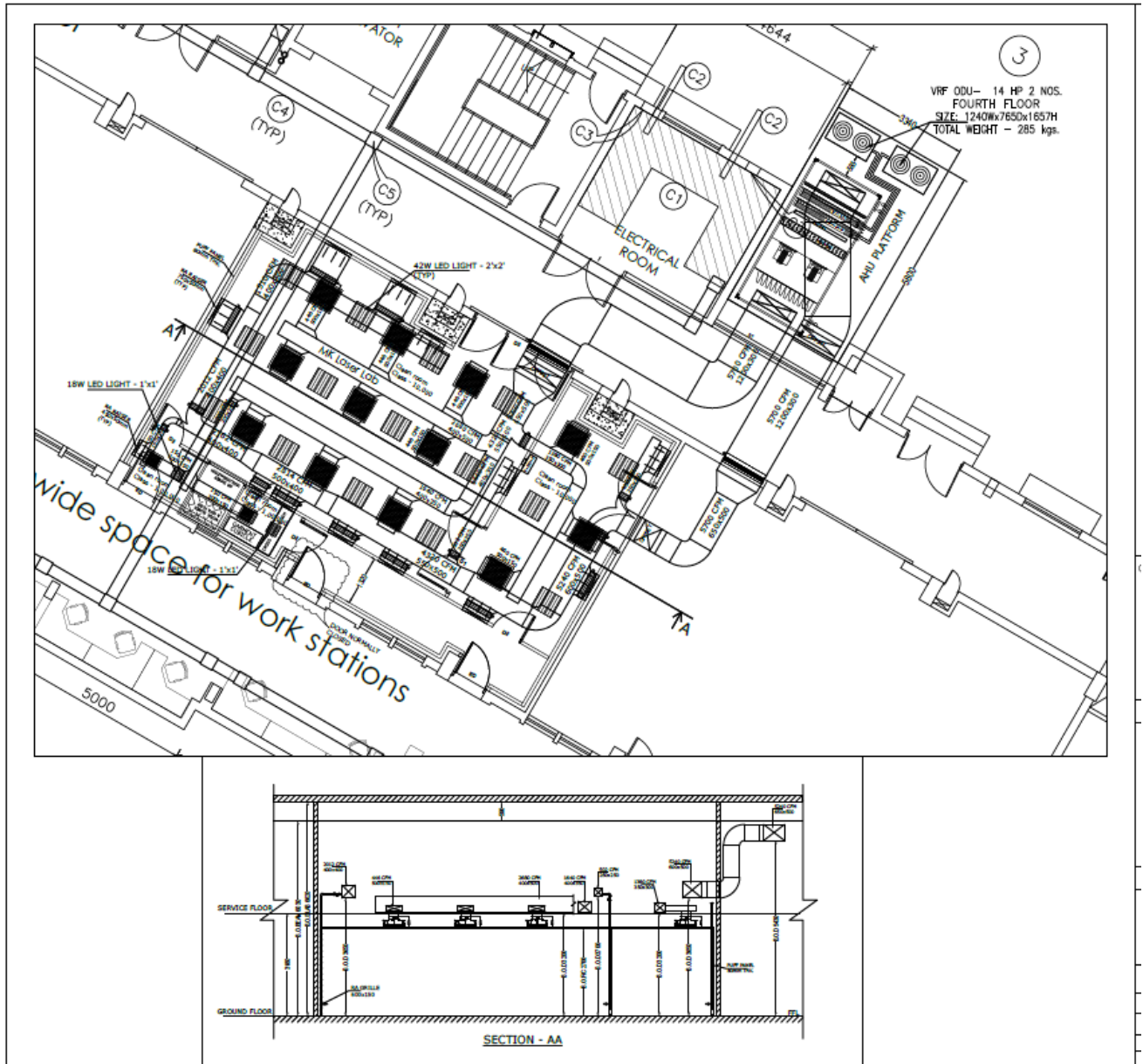
**Self-certification that the item offered meets the minimum local content (as above) giving details of the location(s) at which the local value addition is made in case the bidder wishes to avail the benefits under the make in India policy, if applicable.**

**In cases of procurement for a value in excess of Rs.10 crores, the local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content to avail the benefits under the make in India policy, if applicable.**



**ANNEXURE-IV**

**CLEAN ROOM DUCTING LAYOUT**



**ANNEXURE-V**

**TECHNICAL DATA SHEETS**

**1. VRF OUTDOOR UNITS:**

Sl. No.	Parameter	20 HP	18 HP	16 HP	14 HP	12 HP	10 HP	8 HP
1	Country of origin							
2	Model number							
3	HP rating							
4	Capacity at nominal conditions (TR)							
5	Capacity at actual conditions (TR)							
6	IKW / TR at nominal conditions							
7	IKW / TR at actual conditions							
8	COP at nominal conditions							
9	COP at actual conditions							
10	Capacity control							
11	Ambient temperature operating range							
12	Operating sound – dB (A) – normal mode							
13	Operating sound – dB (A) – quiet mode							



14	Running amps (A)							
15	Power input (KW)							
16	Dimensions in mm (H x W x D)							
17	Net weight (Kg)							
18	Minimum distance required between two units ( mm )							
19	Plant Area required to keep all the outdoor units							
20	Whether VRF ODU can be used for cooling in summer and heating in winter? PI confirm.							
21	Warranty							

Nominal Conditions: indoor suction air temperature 27 deg. C DB, 19 deg. C WB and outdoor suction air temperature 35 deg. C

Actual conditions: indoor suction air temperature 23 deg. C DB, 17 deg. C WB and outdoor suction air temperature 50 deg. C

**Factory Pre Dispatch Test: Mandatory. All arrangements (Transport, lodging, Boarding, etc) are to be arranged by the supplier for TIFR officials.**

**2. AIR HANDLING UNIT:**

SL.NO.	PARAMETER	DETAILS
<b>1.0</b>	<b>GENERAL:</b>	
1.1	Make	
1.2	Model	
1.3	Type	
1.4	Capacity (TR)	
1.5	Air Quantity (Cfm)	
1.6	Total Static Pressure (mm of Wg)	
1.7	External Static Pressure (mm of Wg)	
1.8	Noise level at 1mt.distance from filter section at 1mt height (dBA)	
1.9	Inner Skin	
1.10	Outer Skin	
1.11	Type of Insulation	
1.12	Thickness of Insulation	
1.13	Density of Insulation	
1.14	Thermal Conductivity of Insulation	
1.15	Thickness of aluminium extrusions	
1.16	Aluminium Extrusions – Thermal Break / Non Thermal Break	
1.17	Material & thick of base frame	
<b>2</b>	<b>FAN SECTION:</b>	
2.1	Make	
2.2	Model	



2.3	Type of fan	
2.4	No.of fans	
2.5	Motorized damper at outlet of fan	
2.6	Air Quantity (Cfm)	
2.7	Total Static Pressure (mm of Wg)	
2.8	Speed (RPM)	
2.9	Break Horse Power (Kw)	
2.10	Motor Rating (Kw)	
2.11	Fan Outlet Velocity (mt./sec)	
2.12	Noise level (dBA)	
2.13	Fan Efficiency (%)	
2.14	Motor Efficiency (%)	
<b>3</b>	<b>COOLING COIL SECTION:</b>	
3.1	Face Area (sq.mt.)	
3.2	Tube dia.(mm)	
3.3	Tube length (mm)	
3.4	Tube high (mm)	
3.5	Tube pitch (mm)	
3.6	No.of rows	
3.7	No.of fins per inch	
3.8	Face Velocity (FPM)	
3.9	Entering air temp. DB / WB (deg.F)	
3.10	Leaving air temp. DB / WB (deg.F)	
3.11	Air side pressure drop (mm of Wg.)	
3.12	Refrigerant Flow (USGPM)	



3.13	Refrigerant Temp.in (deg.F)	
3.14	Refrigerant Temp.out (deg.F)	
3.15	Refrigerant side pressure drop (PSI)	
3.16	Capacity of the Coil (TR)	
<b>4</b>	<b>HEATER SECTION:</b>	
4.1	Face Area (sq.mt.)	
4.2	No.of steps	
4.3	Face Velocity (FPM)	
4.4	Entering air temp.DB / WB (deg.F)	
4.5	Leaving air temp.DB / WB (deg.F)	
4.6	Air side pressure drop (mm of Wg.)	
4.7	Capacity of heater (KW)	
<b>4.8</b>	No. of heaters	
<b>5</b>	<b>PRE FILTERS:</b>	
5.1	Filter Area (Sq.mt.)	
5.2	Air Velocity Across the Filter (mt./ sec)	
5.3	Pressure drop across the filter clean / dirty (mm of Wg.)	
5.4	No.of filters	
5.5	Size of filter (mm x mm x mm)	
5.6	MERV	
5.7	Commissioning Filters	
<b>6</b>	<b>FINE FILTERS:</b>	
6.1	Filter Area (Sq.mt.)	
6.2	Air Velocity Across the Filter (mt./ sec)	



6.3	Pressure drop across the filter clean / dirty (mm of Wg.)	
6.4	No. of filters	
6.5	Size of filter (mm x mm x mm)	
6.6	MERV	
<b>7</b>	<b>SECTIONS:</b>	
7.1	Mixing Box Section	
7.2	Coil Section	
7.3	Fan Section	
7.4	Fine Filter Section	
<b>8</b>	<b>DAMPERS:</b>	
8.1	Supply Air	
8.2	Return Air	
8.3	Fresh Air	
8.4	Fan Outlet - Motorized	
8.5	Bleed Off Damper	
<b>9</b>	<b>ACCESSORIES:</b>	
9.1	Marine Lamp with Switch in mixing box section, fan section and fine filter section	
9.2	Limit Switch for blower section access door	
9.3	Viewing Port for fan section	
9.4	Pressure sensing probes for pre filters and fine filters	
10	Warranty	

Note: Enclose coil and fan selection sheet with operating points

**Factory Pre Dispatch Test: Mandatory. All arrangements (Transport, lodging, Boarding, etc) are to be arranged by the supplier for TIFR officials.**



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**SECTION-VII**

**FINANCIAL BID**

**INVITATION OF BIDS FOR**

**Supply, Installation, Testing and Commissioning of HVAC System and other related works for 10000 Class clean room at TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.**

**PART II**

**FINANCIAL BID**





**SCHEDULE OF QUANTITIES**

S.No	Work Description	Qty (A)	Unit	Rate (B)	Amount C=AXB
1	Supply of 16Hp Variable Refrigerant Flow Out Door package consisting of compressors, condensers, R 410 A refrigerant, fans, control panels, etc. as per specifications. The capacity shall be the nominal capacity. Minimum efficiency of VRF needs to be in line with ASHRAE standards. Minimum COP of VRF ODUs shall be 4.0. Units shall be selected for ambient temperature of 50 deg. C. Derating shall not be more than 20% at 50 deg. C ambient conditions. VRF ODUs shall be capable of integrating with stand alone controllers with RS485 Modbus protocol. Necessary Civil foundation & MS stand shall be considered for ODU with one coat of primer painting and two coats of finish painting. Necessary hardware and software required for connecting it to a third party stand alone controller shall be considered.	2	No		
1(a)	Installation, Testing and Commissioning of <u>S.No.1</u> i.e. 16Hp Variable Refrigerant Flow Out Door package consisting of compressors, condensers, R 410 A refrigerant, fans, control panels, etc. as per specifications. The capacity shall be the nominal capacity. Minimum efficiency of VRF needs to be in line with ASHRAE standards. Minimum COP of VRF ODUs shall be 4.0. Units shall be selected for ambient temperature of 50 deg. C. Derating shall not be more than 20% at 50 deg. C ambient conditions. VRF ODUs shall be capable of integrating with stand alone controllers with RS485 Modbus protocol. Necessary Civil foundation & MS stand shall be considered for ODU with one coat of primer painting and two coats of finish painting. Necessary hardware and software required for connecting it to a third party stand alone controller shall be considered.	2	No		
2	Supply, Installation, Testing and Commissioning of 13TR / 5700 CFM at 85MMWG External static Air Handling Unit. Air Handling Unit shall be Double skin 50mm thick, floor mounted 40±2kg density PUF insulated, 0.8mm thick GI plain sheet inside and 0.8mm pre coated GI sheet outside, mounted on a base channel, Draw through type,	1	No		



	<p>Thermal Break profile with mixing box for return air &amp; fresh air, pre filter section EN 779:G4 filters with frame, 2 no. Cooling Coil section with 6 Row Deep DX cooling coil (Coil placing one after the other) in the AHU section. One coil needs to be connected to working VRF ODUs and a second coil shall be connected to stand by VRF ODU. Insulated SS304 drain Pan, Fan section along with direct driven plug fans 2nos (1 working + 1 standby), Fine filter section with EN 779:F9 fine filters along with frame. Fan section should have a limit switch &amp; View Glass. Manually operated VCDs with extruded aluminium aerofoil design for fresh air, return air, bleed air &amp; supply air outlet. Motors shall be suitable for VFD operation. AHU shall be designed with sufficient space between sections with access door across. The fan outlet air velocity shall not exceed 9.5 mt./sec. Air velocity across Coil and filter shall not exceed 500 FPM &amp; 400 FPM respectively. Coil by pass damper shall be provided. AHU shall have a canopy suitable for outdoor installation. AHU shall have internal coving in the aluminium extrusions. Heavy duty gravity dampers / Back Draft Dampers shall be provided at the fan outlet for working fan and stand by fan.</p> <p>AHU shall be connected to 2 no. 16HP (1w+1s) VRF ODUs shall be independently connected to the coil with dedicated coil kit and controller. Coil kit controller shall be suitable for integrating with stand alone controller with Modbus protocol.</p> <p>Probes shall be provided for differential pressure measurement across filters &amp; fans with Magnehelic Gauges and sensing probes. Vibration Isolators for AHU shall be provided with vibration isolation efficiency 95%. DX type cooling coils shall be suitable for connecting the VRF coil kit along with the controller. Working and standby fans shall be interchanged from controller automatically as per the schedule.</p> <p>AHU shall have IAQ UVGI system in supply duct to generate necessary UV-C light to achieve kill rate of minimum 99% in single pass. UV lamps shall be fixed with necessary framework and shall be installed inside the supply duct. By-products should not be CO<sub>2</sub> / O<sub>3</sub>. UV lamps shall be suitable for above mentioned air quantity. UV C dosage shall be minimum 3000 uW-sec/cm<sup>2</sup>. Required intensity shall be calculated based on the air velocity and duct size. UVGI system shall be integrated to stand alone controller.</p>				
3	Supply, Installation, Testing and Commissioning of Duct mounted electric type strip	1	No		



	heater module of 3.0 kW x 4 nos ( 3 no. heaters shall be working & 1 no. heater will be stand by) with control & wiring to maintain the RH to be accommodated in the Supply air duct (Duct Size: 1200X300 mm). Control panel shall have isolators, safety thermostat, 2-stage humidistat for switching ON the heaters in 2-stages, air flow switch, etc. Heater bank shall be suitable for integration to the controller for monitoring and operation. Heater Bank shall be allowed to operate manually also and suitable for outdoor installation.				
4	Supply, Installation, Testing and Commissioning of 3KW capacity pan humidifiers with actuator, SS tank, fresh water connection, overflow connection, drain connection, humidistat for controlling the RH with in $\pm 5\%$ , supports, etc.,. Pan humidifier shall be suitable for integration with stand alone controller. Shall be allowed to operate manually also. Air flow switch shall be provided to switch off the pan humidifier in case of no air flow.	1	No		
5	Supply, Installation, Testing and Commissioning of Refnet Joints for all Indoor unit / AHU if as required.	1	Lot		
6	Supply, installation, testing and commissioning of complete VRF system with AHUs controllers including pressure testing and initial charge of refrigerant gas - R 410 A	1	Lot		
7	Supply, Installation, Testing and Commissioning of copper refrigerant piping of 4/8 inch dia. size with 18 SWG hard drawn copper piping necessary supports, fittings and clamps, insulation with 19 mm thk class 'O' nitrile rubber insulation. Copper piping shall be of VRF grade with 100% eddy current testing. All wall crossings with proper PVC sleeves. Exposed insulation shall be glass cloth lamination and painted with two coats of UV resistant paint. Low / nill VOC adhesive shall be used.	20	RMT		
8	Supply, Installation, Testing and Commissioning of copper refrigerant piping of 1 1/8 inch dia. size with 18 SWG hard drawn copper piping necessary supports, fittings and clamps, insulation with 19 mm thk class 'O' nitrile rubber insulation. Copper piping shall be of VRF grade with 100% eddy current testing. All wall crossings with proper PVC sleeves. Exposed insulation shall be glass cloth lamination and painted with two coats of UV resistant paint. Low / nill VOC adhesive shall be used.	20	RMT		



9	Supply, Installation, Testing and Commissioning 3C * 1.5 sq. mm. unarmoured copper cable in 20 mm dia FRLS PVC conduit for communication between indoor and outdoor unit / AHUs of VRF system	40	RMT		
10	Supply, Installation, Testing and Commissioning of 32mm dia CPVC drain piping with supports, GI Tray, clamps and insulation with 9 mm thk class 'O' nitrile rubber insulation. Insulation shall be FM Approved. Low / nill VOC adhesive shall be used. Exposed insulation shall be glass cloth lamination and painted with two coats of UV resistant paint.	10	RMT		
11	Supply & Installation of hot dipped galvanized tray of 1.6 mm thk. and 75 mm height. 300mm width. All required supports, fittings, bends, offsets, bolt & nuts, etc. shall be included. This cable tray is meant for copper piping in the building, exposed terrace and for electrical cables including wall chipping and closing with proper sleeve, cement and smoke to be applied after testing and commission of all equipment.	10	RMT		
12	Supply & Installation of hot dipped galvanized tray of 1.6 mm thk. and 50 mm height. 300mm width. All required supports, fittings, bends, offsets, bolt & nuts, etc. shall be included. This cable tray is meant for copper piping in the building, exposed terrace and for electrical cables including wall chipping and closing with proper sleeve, cement and smoke to be applied after testing and commission of all equipment.	10	RMT		
13	Supply, Installation, Testing and Commissioning of GSS ducting square / rectangular Factory Fabricated Ducting (120GSM) of thickness 0.63 mm sheet (24G) complete with gaskets, elbows, splitters, vanes, cowls, supports arrangement using GI full threaded rods and slotted rails as per drawings, air distribution specifications and requirements. Ducts are joined with iron angle frames with suitable nuts, bolts, gaskets etc., Proper care shall be taken to avoid noise and vibrations. Sleeves shall be provided at wall crossings. Ducting shall be smoke tested before insulation. Ducting shall be designed for 1000 pascals ESP for supply air ducting and 500 pascals ESP for exhaust or return air ducting as per SMACNA-2005 & specifications	180	Sq M		
14	Supply, Installation, Testing and Commissioning of GSS ducting square / rectangular Factory Fabricated Ducting (120GSM) of thickness 0.80 mm sheet (22G) complete	55	Sq M		



	with gaskets, elbows, splitters, vanes, cowls, supports arrangement using GI full threaded rods and slotted rails as per drawings, air distribution specifications and requirements. Ducts are joined with iron angle frames with suitable nut, bolts, gaskets etc., Proper care shall be taken to avoid noise and vibrations. Sleeves shall be provided at wall crossings. Ducting shall be smoke tested before insulation. Ducting shall be designed for 1000 pascals ESP for supply air ducting and 500 pascals ESP for exhaust or return air ducting as per SMACNA-2005 & specifications				
15	Supply, Installation, Testing and Commissioning of GSS made volume control damper with opposed blades as per the tender specification, frame shall be made of 18G and blades shall be made of 20G. Blades shall be aerofoil double skin low leakage type and volume control of 0-100% complete with neoprene rubber gasket, nuts, bolts, screws linkages, flanges etc.	2	Sq M		
16	Supply, Installation, Testing and Commissioning of Aluminum extruded black powder coated collar damper for grilles and diffusers. Collar dampers shall be fixed on the grills / diffuser or in the collar.	1	Sq.M		
17	Supply, Installation, Testing and Commissioning of fusible link and with limit switch fire damper with sleeve made of 16 G GI sheet. The damper shall have fire rating of 90 minutes as per UL 555 listed & stamped and shall be installed at all wall crossings in SA / RA ducts. Size of the fire damper shall be less than 0.5 sq.ft.	2	Sq.M		
18	Supply, Installation, Testing and Commissioning of Aluminium powder coated Fresh air louvers of non vision type with nylon mosquito net etc. as per approved drawings	0.5	Sq.M		
19	SITC of factory made fire retardant canvas cloth for connecting the AHU inlets & outlets to duct connection with GI strip, nut, bolts & accessories as required.	1	Sq.M		
20	Supply, Installation, Testing and Commissioning of 25 mm thk. Class 'O' Nitrile rubber insulation for supply air ducting for the cleanroom as per the specification. Insulation shall have factory laminated glass cloth. All joints shall be sealed with self adhesive tape.	135	Sq.M		



21	Supply, Installation, Testing and Commissioning of 19 mm thk. Class 'O' nitrile rubber insulation for return air ducting for the cleanroom as per the specification. Insulation shall have factory laminated glass cloth. All joints shall be sealed with self adhesive tape.	100	Sq.M		
22	Supply & installation of 25 mm thick Class 'O' Nitrile rubber insulation for all exposed supply ducts in non-air conditioned areas and outside the building. The insulation shall be finished with polythene paper and 24G chicken wire mesh and finished with 24G aluminum cladding	15	Sq.M		
23	Supply & installation of 19 mm thick Class 'O' Nitrile rubber insulation for all exposed return ducts in non-air conditioned areas and outside the building. The insulation shall be finished with polythene paper and 24G chicken wire mesh and finished with 24G aluminum cladding	20	Sq.M		
24	Supply, Installation, Testing and Commissioning of stand alone DDC controller with HMI touch display to view the parameters and change the set points, etc. Controller shall have a panel with necessary wiring. Controllers shall communicate with VRF equipment / controllers, VFDs and shall have I/Os for operation, monitoring, scheduling, auto changeover, RH control, etc. Shall have auto manual switch, on/off command, on/off status, trip, temperature sensor, RH sensor, dp switches for fan run status, pre filter, fine filter and terminal hepa filters status and shall operate heater module and pan humidifier automatically based on the RH set point. Shall have password protection and provision to change the set points. If the controller is under maintenance, the system should operate automatically in manual mode.	1	No.		
25	Supply, installation, testing and commissioning of outdoor / indoor electrical panel of 3 phase 415 V floor mounted made out of 14G MS sheet after seven tank processes and painted with Epoxy powder coating as required. The panel shall have a busbar chamber, cable chamber, incoming module, metering module, outgoing modules, etc. Panel shall have all provisions required for integrating with third party stand alone controller / BMS for auto operation. Shall have necessary timer for scheduling and change over integration for operation in manual mode. 125 A MCCB Incomer	1	No.		



	1 x 63 A MCCB outgoing for VRF Outdoor units with necessary contactors - 2 no. 1 x 63 A MCCB out going for AHU with VFD and star delta bypass starter - 2 no. 3 x 32 A MCCB outgoing for heaters with necessary contactors 1 x 20 A MCB outgoing for 3 KW pan humidifier with necessary contactors 1 x 20 A TPN MCB outgoing for lighting distribution panel 1 x 63 A MCCB outgoing as spare 1 x 63 A MCCB outgoing with star / delta starter as spare 1 x 32 A MCCB outgoing as spare				
26	SITC of power isolators for VRF odu units, Isolators shall be Indoor/Outdoor as required with required metal box, ELCB isolators of required capacities etc.	2	No.		
27	Supply, Installation, Testing and Commissioning of 300mm size Factory Fabricated GI ladder type Cable Tray with all accessories for fixing and laying	30	RMT		
28	Supply, Installation, Testing and Commissioning PVC Armoured Aluminium conductor power Cabling for various equipment including clamps, double compression glands, lugs, end terminations of 3.5 C x 25 sq. mm for VRF Outdoor units	60	RMT		
29	Supply, Installation, Testing and Commissioning PVC Armoured Aluminium conductor power Cabling for various equipment including clamps, double compression glands, lugs, end terminations of 4 C x 16 sq. mm for AHU	60	RMT		
30	Supply, Installation, Testing and Commissioning PVC Armoured Aluminium conductor power Cabling for various equipment including clamps, double compression glands, lugs, end terminations of 4 C x 10 sq. mm for heaters	30	RMT		
31	Supply, Installation, Testing and Commissioning PVC Armoured Aluminium conductor power Cabling for various equipment including clamps, double compression glands, lugs, end terminations of 4 C x 6 sq. mm for humidifier	30	RMT		
32	Supply, Installation, Testing and Commissioning of 3 C x 1.5 Sqmm armoured Copper Control Cabling with end terminations	60	RMT		



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33	Supply, Installation, Testing and Commissioning of 3 C x 2.5 Sqmm armoured Copper Control Cabling with end terminations	60	RMT		
34	Supply, Installation, Testing and Commissioning of 25 x 3 mm thick GI Flat	30	RMT		
35	Supply, Installation, Testing and Commissioning of 6 SWG GI Wire	30	RMT		
36	Supply, Installation, Testing and Commissioning of 8 SWG GI Wire	30	RMT		
37	Supply, installation, testing and commissioning of outdoor type remote push buttons with lockable off and on push buttons for AHU with two fans.	1	No		
38	Supply, fabrication, installation and painting of structural platform with MS I-beams / Channels / Angles with supports, checkered plate, grouting, grouting fasteners, etc for AHU. Structural platform shall be painted finally with one coat of primer and two coats of finish paint with approved colour shade. Rates shall be inclusive of Civil foundation works for steel structure columns as suggested by TIFR engineer.	2000	Kgs		
39	Making openings and closing of the brick wall/RCC beams openings with necessary cutting tools, sand and cement, finishing the same with plastering, painting to match with the existing wall finish with primer coat and two coats of wall paint. This is for the ducts passing through the brick walls and for other services. Wall thickness will be around one foot.	2	SqM		
40	Validation of cleanroom and documentation of cleanroom for air velocity test, DP test, particle count, cleanroom classifications, pressure balancing, temperature test, RH test, laminar flow visualization video, recovery test with video, etc. Validation shall be done by an approved third party and documents shall be professionally prepared. All the formats shall be submitted for review and approval by the client. Whatever modifications, adjustments need to be done for achieving the proper results shall be carried out before the final test. If the test results are not satisfactory, testing shall be repeated at no extra cost.	1	Lot		
					Sub Total (D)





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	GST @ 28% on Item No.1 (E)	
	GST @ 18% on Item No.1(a) to 40 (F)	
	Total Amount (G= D+E+F)	
	Total Amount in words Rs.....only	

**Note:**

- 1. Rates are all inclusive of profit, Transport, Loading & Unloading, Taxes, Etc.**
- 2. TIFR, Hyderabad has right to delete any of above items from scope of work or may increase/reduce quantities as per its requirement during execution of work. No claim or compensation for such deletion/increase/decrease will be accepted/paid to the contractor. Payment will be made as per actual quantities executed at tender rates**
- 3. Manufacturer's warranty of respective supply items to be provided.**
- 4. For any above item quantity exceeding more than 10% of projected qty, contractor shall take prior approval from TIFR Engineer in writing.**
- 5. For any deviating items, the contractor shall take prior approval from TIFR Engineer In charge with proper rate analysis.**