



**GOVERNMENT OF INDIA  
DEPARTMENT OF ATOMIC ENERGY  
NUCLEAR FUEL COMPLEX**

**TENDER DOCUMENT FOR**

**Providing centralized Air conditioning system in wing -1 removing old AC system in control lab” in NFC, Hyderabad.**

**TWO PART e-TENDER**

**Tender No: E/527/2017**



**Electrical Projects (Ventilation),  
2<sup>nd</sup> Floor, Saarathi Building,  
ECIL Post, Hyderabad - 500 062**

**Tender No: E/527/2017**

**Name of the work: Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.**

**INDEX**

<b>S. No</b>	<b>DESCRIPTION</b>	<b>PAGE NO</b>
1	NOTICE INVITING e-TENDER (NIT)	3-12
2	ITEM RATE TENDER & CONTRACT FOR WORKS	13-14
3	ACCEPTANCE PROFORMA	15
4	FORMS- A TO G	16-23
5	APPENDIXES- I TO V	24-29
6	PROFORMA SCHEDULES (A TO F)	30-33
7	DETAILED TENDER SPECIFICATIONS	34-66
8	PREAMBLE TO SCHEDULE OF QUANTITIES	67-70
9	SCHEDULE OF QUANTITIES	70-76
10	DRAWING – PROVISIONAL LAYOUT OF SITE	77
11	CONDITIONS OF CONTRACT	SEPARATE DOCUMENT
12	CONTROL OF WORKS –SAFETY GUIDELINES OF AERB	SEPARATE DOCUMENT

**Government of India  
Department of atomic energy  
Nuclear Fuel Complex  
Electrical projects  
Hyderabad – 500 062**

**NOTICE INVITING e-TENDER (NIT)  
Tender No E/527/2017**

**1.0 Introduction:**

**1.1 On line** item rate tenders (**e-tendering**) in **TWO ENVELOPE SYSTEM** are invited on behalf of the President of India from approved and eligible contractors of DAE, e-registered and those of appropriate list of CPWD, Department of Telecommunications, M.E.S., Railways and State PWD and / or having experience in similar works for the work of

**"Providing centralized AC system in wing-1 and removing old AC system in control lab at NFC Hyderabad"**

**1.2** The estimated cost of the work is approximately **Rs 35.11 Lakhs.**

**1.3** Earnest Money Deposit (EMD) **Rs. 70220/-** (Rupees seventy thousand two hundred and twenty only)

**2.0 Detailed Scope Of Work:**

Detailed Scope of work shall be briefly but not limited to the scope of work as mentioned in **Appendix-II to this Detailed NIT**. The scope of work shall include all specifications, terms and conditions, schedule of rates and its preamble etc. as included in the bidding document and its subsequent Amendment, if any.

**3.0 Time Schedule:** The time schedule for completion of work in all respects shall be 8 (eight) calendar months to be reckoned from the 15<sup>th</sup> day after the date of written orders to commence the work.

**4.0 Fees Payable by the bidder:**

**4.1 Cost of Tender Document:Nil**

**4.2 Transaction fee for Tender processing:Rs. 2019/-** (Rupees two thousand and nineteen only), non refundable drawn in favour of "ITI Limited", payable at New Delhi in the form of Demand Draft/Pay Orders/Banker's cheque from a Scheduled Bank. The payment can also be made through Internet Banking/ Credit Card/ Debit card.

**4.3 Earnest Money Deposit (EMD) 70220/-** (Rupees seventy thousand two hundred and twenty only) shall be submitted in the form of Demand Draft/ Pay Order/ Banker's Cheque / Deposit at Call receipt/ FDR of a Scheduled Bank issued in favour of "Pay& Accounts Officer), NFC," payable at Hyderabad. A part of EMD is acceptable in the form of bank guarantee also. In such cases 50% of earnest money will have to be deposited in the shape prescribed above and balance can be accepted in the form of bank guarantee issued by a scheduled bank.

**4.4** In case the contractor fails to commence the work specified in the tender document as per the time schedule mentioned, then the Government shall, without prejudice to any other right or remedy be at liberty to forfeit whole EMD absolutely.

**5.0** If any Tenderer fails to submit any fee (Tender processing fee/EMD) repeatedly, then Tender Inviting Authority (TIA) will debar the Tenderer for a minimum period of one year

**6.0** No pre bid meeting for this tender. Any queries on the tender may be sent to [krao@nfc.gov.in](mailto:krao@nfc.gov.in) or [crk@nfc.gov.in](mailto:crk@nfc.gov.in) for clarification

**7.0 Important dates:**

<b>Tender Document available on website <a href="http://www.tenderwizard.com/DAE">www.tenderwizard.com/DAE</a> for free view &amp; download</b>	<b>: 06.07.2017 to 22.07.2017 upto 14:00hrs</b>
<b>Last Date and time of online submission/ uploading of Bid including Bidder's credentials, attested copies, and all fees / EMD</b>	<b>: 10.08.2017 upto 14:00hrs</b>
<b>Last date for submission of Hard Copies to NFC Office</b>	<b>: 18.08.2017 upto 14:00hrs</b>
<b>Place of Submission of hard copies of Bid Fees, EMD</b>	Dy. Chief Engineer (CED,PD & EP) , Civil Engineering Division-Electrical Projects, 2 <sup>nd</sup> Floor, Sarathi Building, Nuclear Fuel Complex, Hyderabad-500062, India <u>To be handed over in the Office</u>
<b>Date and time of online opening of Part -I (Eligibility &amp; Technical bid)</b>	<b>: 18.08.2017 upto 15:00hrs</b>
<b>Date and time of on line opening of Part-II (Financial Bid)</b>	: Will be intimated to the qualified bidders later on.
<b>Bid Validity</b>	: The Bid shall be valid for a period of 120 (One hundred and twenty) days from the date of submission of Part-I (Eligibility & Technical Bid)
<b>Contact Person of NFC for clarification/ information</b>	: Shri B S V S Kameswara Rao, Dy. Chief Engineer (CED,PD & EP) Ph: 040-27184025, Fax: 040 -27122532.

**8.0 Registration in website & downloading the tender document**

a) Agencies registered in Tender wizard only can purchase / download & submit / upload tenders.

b) Agencies interested to participate shall have class-III valid Digital Signature Certificate (DSC) and register themselves under tender wizard only, and subsequently can download and submit/upload bid. Details of registration for e-tendering will be available on website [www.tenderwizard.com/DAE](http://www.tenderwizard.com/DAE) under icon “enrolment”. For assistance/clarifications if any contact Sri Vijay Kumar 7207042074 or 9666515154, DAE helpdesk.

**The registration process will take about 4 days. Advance action for registration is advised.**

c) However, Bidder can view the tender document without registration and DSC but can't upload / download schedules for participation.

d) Bidders may get class-III Digital signature from any reputed IT organization like e-mudra, TCS, MTNL, GNFC etc. Subsequently, User ID and password shall be obtained for participation in tendering by registering in website [www.tenderwizard.com/DAE](http://www.tenderwizard.com/DAE) under icon “enrolment”.

## **9.0 Bidder's Eligibility Criteria (BEC)**

### **9.1 Experience Criteria (Eligibility criteria for participation in tendering)**

Estimated Cost for the work is **35.11 Lakhs.**

(A) Bidder should have satisfactorily completed during **last 7 years** ending 1.4.2017

**One** similar completed work not less than **80%** of Estimated cost i.e. **Rs. 28 Lakhs**

**‘OR’**

**Two** similar completed works **each** costing not less than **60%** of Estimated cost i.e. **Rs. 21 Lakhs**

**‘OR’**

**Three** similar completed works **each** costing not less than **40%** of Estimated cost i.e. **Rs. 14 Lakhs.**

Attested copies of experience certificates as proof of evidence as stated above are to be uploaded and to be submitted.

**(B) The value of executed work will be brought to the current costing level by enhancing the actual value of work at simple rate of 7% per annum** to be calculated from the date of completion to the last date of receipt of tender as mentioned in NIT. The cost of materials supplied free of cost by the Client, shall be excluded in value of order.

**(C) For the purpose of this clause, ‘similar work’ means “ Supply and erection of air handling units, condensing units along with required electrical, piping, ducting, dampers, grilles & associated supporting structure etc.**

### **9.2 Financial Criteria (Eligibility criteria for participation in tendering)**

#### **(A) Turnover**

**(I) The average annual financial turn over on works contracts** should be at least **100% of the estimated cost** during the immediate last 3 consecutive financial years.

**(II) The Bidder should not have incurred any loss in more than two years during last 5 years period ending with last financial year.**

**(III) Copy of Auditor's Balance sheet and duly filled in FORM-C** included in the Tender document **should be uploaded and submitted by bidders in support of the Annual Turnover criteria.** The full audited financial statement with all schedules and profit and loss account shall be uploaded in website by the bidder.

The **turnover** shall be a certificate from the **Chartered Accountant** for the **last five years** as mentioned in the Tender Document should also be uploaded.

**(B) Solvency:**

Bidder should have the solvency equal to **40%** of the estimated cost of the work i.e. **Rs. 14 Lakhs.**

Copy of **Fresh Solvency Certificate** issued by any scheduled Bank after 01.04..2017 (as per **Appendix-III to detailed NIT**) and **FORM-D of this Tender document** are required to be uploaded and submitted.

**(C) Bidding Capacity:**

The bidding capacity of the bidder should be equal to or more than the estimated cost of this Tender work. The bidding capacity shall be worked out by the following formula:

$$\text{Bidding Capacity} = [ A \times N \times 2 ] - B$$

Where,

**A = Maximum value of turn over in any one year during the last five financial years** taking into account the completed as well as works in progress with current costing level by enhancing the actual value of work at simple interest of **7% per annum**, calculated from the date of completion to last date of tender as mentioned in NIT.

**N = Number of years prescribed for completion of work** for which bids has been invited.

**B = Value of existing commitments** and ongoing works to be completed during the period of completion of work of this tender.

**The Auditor's certificate to the information given by the bidder and bidding capacity of the bidder shall be uploaded and submitted.**

**(D) Copy of Registration of VAT(TIN) and PAN**

**9.3 Technical and Administrative Personnel:** List of Technical Staff and administrative personnel possessed by bidder is to be indicated. The requirement of Technical Staff and administrative personnel for the work proposed to be deployed by the bidder for completion of work in all respects are as per **FORM-F to this Detailed NIT.**

The period of absence of technical manpower will be charged and deducted from your bills as per **Schedule – F** included in the tender document

**9.4 Plant, Equipment and Machinery:** Plant, minimum equipment and machinery required for completion of work in all respects within the time schedule **proposed to be deployed or to be hired** for the work shall be as per **FORM-E to this Detailed NIT.**

**10.0 The bid of consortium/ unincorporated joint venture and foreign bidders shall not be taken into consideration.**

**11. SSI/MSME/PSU (Central & State) are not exempted** from submission of EMD, Bid document fee and transaction fee for tender processing. Purchase preference for SSI/MSME/PSU shall not be provided for this tender.

**12. Zero deviation basis:** Bidders are requested to submit their bids on **Zero deviation basis** in total compliance to Tender Document without any deviation / stipulation / clarification / assumption. Accordingly, Bidder must submit format for **“Compliance to Bid requirement”** as per attached format ‘**Appendix-IV to Notice Inviting e-Tender**’, duly filled in along with Techno-Commercial Bid. **Bidders taking deviations to the provisions of Tender Document shall be summarily rejected.**

**13. Certificates to be uploaded (after scanning) and hard copy to be submitted**

(Contractor can upload documents in the form of JPG format / PDF format and also in zip)

1. Experience /performance certificates of works completed and works in hand
2. Audited balance sheets indicating annual turnover
3. Latest solvency certificate (Appendix-III)
4. VAT (TIN) and PAN registration.
5. Transaction/process fee, EMD in original
6. Class of registration of appropriate organization
7. Compliance to Bid requirement by the bidder duly signed (Appendix –IV)
8. Declaration by the bidder duly signed (as per Appendix-V )
9. Confirmation of Time Schedule in the form of Bar Chart for completion of work (as per Appendix-VI)
10. Appendix VII to NIT

**14. Tender document available on website**

Tender document consists of Two Parts. **Part -I (Technical bid), and Part -II (Financial Bid)**. Entire tender document along with drawings if any can be viewed/seen and downloaded from website [www.tenderwizard.com/DAE](http://www.tenderwizard.com/DAE) free of cost for reference only

**14.1 Part -I (Technical Bid)**

This consists of NIT and Detailed Notice Inviting Tender, eligibility criteria, Tender and contract, General rules and directions, Conditions of contract, clauses of contract, safety code, model rules, contractor’s labour regulations, Proforma of registers, special instructions to tenderers, Proforma of annexure and performance security bank guarantee, sketches of safety, standard specifications, and Schedule A to F, except **Schedule B**.

**14.2 Part -II (Financial Bid):**

This consists of Empty **un editable/ PDF** copy of Schedule B (Schedule of quantities) **Schedule B is the financial bid i.e. price only. No other conditions, deviations, clarifications etc. shall be considered in this part.**

### 14.3 Bid Documents:

e-format of 1. Technical evaluation sheets 2. Schedule of quantities.

### 14.4 For participation in the bid, documents are to be downloaded by uploading the “transaction fee for tender processing”.

### 15. Mode of submission of offer:

Offer consists 1) Online submission of Bid-documents. 2) Submission of Hard copies of certificates as per para 13.0

#### 15.1 Online submission of bid documents:

a) Forms of Technical evaluation sheets (form A to G) should invariably filled and documents related to additional information given in Part-I (Technical bid) shall be scanned and uploaded.

**FORM-A:** Similar works completed during last 7 years

**FORM-B:** Projects under execution or awarded

**FORM-C:** Turnover for last 5 years

**FORM-D:** Data of Solvency certificate

**FORM-E:** Construction Plant and Equipment likely to be used in the work

**FORM-F:** List Technical and Administrative Personnel for the work,

**FORM-G:** General Data

b) Financial Bid: This Consists of various items to be carried out for the work and to be read in conjunction with the drawings and specifications for filling the rates.

c) Contractor shall make ready the details of fees for Tender processing fee and EMD as indicated in 4.1, 4.2 & 4.3 of this section. **Contractor has to download the Technical evaluation sheets and schedule of quantities within the time and date indicated in the NIT**, after log on to web site [www.tenderwizard.com/DAE](http://www.tenderwizard.com/DAE) using Digital signature, User id and password and as also giving details of fees (tender form cost and tender processing fee).

d) Contractor has to download the bid documents as above and save on the system (Technical evaluation sheets/ forms A to G and Schedule of Quantities) on the desk top **without changing file names**. The files so downloaded shall be filled-in in all respects and then to be uploaded with input of EMD details.

#### e) Mode of filling for Financial Bid (Part-II)

Bidder/contractor must ensure to quote rate of each item. The column meant for quoting rate in figures appears in **YELLOW** colour and the moment rate is entered, it turns **SKY BLUE**. However, while selecting if any cell is left blank/filled vacant, the value for that cell will be taken as “0” by software which indicates that the item is being considered free of cost. A warning will be available for such unfilled cells. Hence, bidder should ensure that the rates of all items shall be filled properly before uploading/ submission.

After submission of bid, bidder can resubmit revised bid any number of times but before last date and time of submission of bid as notified.

While submitting revised bid, bidder can revise the rate of one or more item(s) any number of times but before last date and time of submission of bid as notified.

Bidder shall not disclose rates quoted in Part –II (Financial Bid) nor shall enclose/submit any hard copy along the documents in Part-I



**f) No hard copies of Filled-up Technical evaluation sheets forms A to G of Technical Bid and Schedule of Financial Bid are required to be submitted.**

**g) Vendor manual may be referred which is available on [www.nfc.gov.in](http://www.nfc.gov.in)** for steps involved in e- tendering participation i.e., down loading and up loading of Bid documents- Technical evaluation sheets forms A to G of Technical Bid and Schedule of Quantities. For help contact M/s ITI personnel as given above.

**h)** For further assistance, contact personnel indicated in para 7.0 of this section.

### **15.2 Submission of Hard copies:**

**a)** These original documents of fees and EMD shall be placed in single sealed envelope superscribed as “**Earnest Money and Transaction Fee for Tender Processing**”.

**b)** Copy of Enlistment Order and certificate of work experience and other documents as specified in the detailed tender notice under para 13.0 shall be scanned and uploaded to the e-Tendering website within the period of bid submission and certified copy of each shall be deposited in a separate envelop marked as “**Other Documents**”.

**c) Document Certification:** All pages of Techno-Commercial documents for pre-qualification/ qualification are to be self attested. However, NFC reserves its right to verify authenticity of any such documentation/ certification at their own discretion directly from the concerned certificate issuing authority/ offices.

**d)** Both the envelopes (Fee and other documents) shall be placed in another envelope with due mention of Name of work, date & time of opening of bids **addressed to Dy.Chief Engineer (CED,PD & EP), 2<sup>nd</sup> Floor, Sarathi Building, Nuclear Fuel Complex, Hyderabad-500 062** and to be handed over in the above office on or before last date and time of submission as given in this NIT

**16.0** The Delayed or late offers will be summarily rejected. Department will not be responsible for Postal delays.

**17.0** Online bid documents submitted by intending bidders shall be opened only of those bidders, whose Earnest Money Deposit and e-Tendering Processing Fee and other documents placed in the envelope are found in order. Consequently Part-I (technical bids) will be opened.

**18.0 Part-II (Financial Bid): shall be opened only of those bidders who qualify eligibility criteria and Technical Bid evaluation. The date of opening of Part-II (Financial Bid) will be communicated to the qualified bidders only. Therefore, bidders are required to submit the requisite data with documents in Part -I (Technical Bid) itself.**

**19.0** The EMD of bidders who are not qualified during qualification and Technical bid evaluation stage will be returned along with the letter indicating the reasons of their disqualification.

**20.0** The bid submitted shall become invalid and Transaction Fee for Tender processing shall not be refunded if:

- The bidder is found ineligible.
- The bidder does not upload all the documents (including service tax registration/VAT registration/ Sales Tax registration) as stipulated in the bid document.

If any discrepancy is noticed between the documents as uploaded at the time of submission of bid and hard copies as submitted in the envelopes (Fee & other documents) physically in the office of tender opening authority.

**21.0 Performance Guarantee (PG):** The bidder whose offer is accepted is required to submit **Performance Guarantee within a period of 15 days from the date of award of work. Performance Guarantee shall be 5% of tendered and accepted value.** It can also be in the form of Demand Draft/Pay Order/Banker's cheque/Deposit at Call receipt/FDR of a Scheduled Bank issued in favour of Pay & Accounts Officer, NFC payable at Hyderabad or Bank Guarantee from any scheduled Bank **valid up to stipulated date of completion plus 60 days** beyond that along with an additional claim period of six months accepted by Engineer-in-charge or as mentioned in LOA or Order issued by the Department.

**22.0 Security Deposit (SD):** During execution of work, **Security Deposit (SD)** will be deducted from Running Bills @ **2.5% of tendered and accepted value.** The EMD submitted along with the Tender will be returned after receipt of performance guarantee.. If so desired by the contractor, the total SD amount can be deposited in the form of Demand Draft or Pay Order or Banker's Cheque or Deposit at call Receipt or FDR in favour of Pay & Accounts Officer, NFC payable at Hyderabad.

Performance Guarantee will be refunded to contractor without any interest only on successful completion of contract and on production of work completion certificate from concerned officer-in-charge. Security deposit will be returned after completion of guarantee period of 12 months or after payment of final bill whichever is later.

**23.0** Income Tax and VAT on Works contract as applicable will be recovered from the bills payable to the contractor.

**24.0 Bid Validity:** The tender for the works shall remain open for acceptance **for a period as specified in NIT clause no. 7.0** If any bidder withdraws his tender before the said period or makes any modifications in the terms and conditions of the tender which are not acceptable to the department, then the Government shall, without prejudice to any other right or remedy, be at liberty **to forfeit 50% of the said earnest money** as aforesaid. The bidder shall extend the validity period on written request from NFC

**25.0 Other Conditions:**

**Site Visit:** Bidders who are interested to participate in the tender are advised to inspect and examine the site before submission of their tender.

**Bidders who are apparently meeting the eligibility qualification criteria as mentioned in this NIT shall only be allowed to visit site.** For this purpose, bidder to submit copies of qualification documents directly to the contact person of NFC as mentioned in 7.0 above through email for verification and getting confirmation letter from NFC for visiting the site as scheduled by NFC.

The bidder shall be responsible for arranging and maintaining at his own cost all materials, tools & equipments, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which stores, tools and plant, etc., will be issued to him by the Government and local conditions and other factors having a bearing on the execution of the work.

**Police Verification for Labourers:** Police verification certificate (PVC) of all labour engaged at site shall be obtained by the bidder for issuance of entry pass at site. All stipulations and instruction given by security personnel, CISF from time to time shall be scrupulously be followed for entry/ exit of men and materials and as also during execution of work for security purpose. **The rates quoted shall be inclusive of PVC charges** and no extra payment will be paid from department in this regard.

**26. The contractor shall quote his rates considering all required material, men, equipment/ plant/ machinery for satisfactory completion of item in all respects. The rates quoted shall be INCLUSIVE of all the taxes such as Sales Tax/VAT on material, Purchase Tax, Turn over Tax, Excise Duty, Work Contract Tax or any other tax except ESI, EPF & service tax. on materials/work as applicable..Bills will be released on submission of documentary proof towards payment of ESI, EPF, service tax and other applicable taxes.**

**27.0** On bid opening date, the bidders can login in the website so that the position of bidders as per opening and their quoted total amount can be seen.

**28.0 Ambiguities in rates quoted:**

If there are differences between the rates given by the bidder and the amount worked out by him, the following procedure shall be followed.

**The bidder shall quote rates in figures only. Amount of each item and total are generated automatically. Therefore, the rate quoted by the bidder in figures shall be taken as correct.**

**29.0** Bidder shall sign the declaration and to be submitted /uploaded in **PART-I** (Technical Bid )

**30.0** The competent authority on behalf of President of India does not bind himself to accept the lowest or any other tender, and reserves to himself the authority to reject any or all of the tenders received without assigning any reason. **All tenders in which any of the prescribed conditions are not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.**

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

**32.0** The competent authority on behalf of President of India reserves to himself the right of accepting the whole or any part of the tender and the bidder shall be bound to perform the same at the rates quoted.

**33.0** The bidder shall not be permitted to tender for works in NFC (responsible for award and execution of contracts) in which his **near relative** is posted as Assistant Accounts Officer or as an officer in any capacity between the grades of Chief Engineer and Assistant Engineers (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in NFC or in the DAE. Any breach of this condition by the bidder/contractor would render him liable to be removed from the approved list of contractors of this Department.

**34.0** No Engineer of gazetted rank or other Gazetted officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of two years after his retirement from Government service, without the previous permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the tender or engagement in the contractors service.

**35.0** This Notice Inviting Tender shall form a part of the contract document. The successful bidder/contractor, on acceptance of his tender by the Accepting Authority, shall, within **15 days** from the stipulated date of start of the work on signing the contract consisting of:-

**Part-I** (Technical Bid) consist of the notice inviting tender, all the documents including Tender of contract, General rules and directions, clauses of contract, proforma of schedules, safety code, Model rules, contractors labour regulations, proforma of registers, special instructions to tenderers, specifications, **Schedule A to F (except Schedule-B) and drawings**, if any, forming the tender as issued at the time of initiation of tender and acceptance thereof and **Part-II** (Financial Bid) consisting of Schedule of Quantities(**Schedule-B**) together with any correspondence leading thereto.

The uploaded document of this work and subsequent corresponded documents/ amendments will be considered as a part of agreement.

**Dy. Chief Engineer (CED,PD,EP)**  
For and on behalf of the President of India

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NFC IS COMMITTED TO A CORRUPTION FREE WORK ENVIRONMENT. “All the purchase and contracts commitments of NFC will be honoured without the citizen having to pay any bribe. In case any person demands any bribe, it is the duty of a responsible citizen to

inform the matter to the vigilance officer, NFC, Hyderabad. Telephone numbers are: (O): 040 – 27120218, 27184949

**ITEM RATE TENDER & CONTRACT FOR WORKS**

**Name of work: "Providing centralized AC system in wing-1 and removing old AC system in control lab at NFC Hyderabad"**

**Part-I (Technical Bid)**: consists of **two covers** which contains as mentioned below:

**First Cover** in sealed condition superscribed as **“Earnest Money and Transaction Fee for Tender Processing”** and shall contain Transaction Fee for Tender Processing & EMD in separate envelopes as mentioned in NIT. This envelope shall be opened first and original documents shall be verified with the scanned copy of these instruments uploaded.

**Second Cover:** in sealed condition superscribed as **“Other Documents”** shall contain all documents related to **Eligibility Criteria** as mentioned in NIT for pre-qualification and Technical documents as given in Para No.13 of Notice inviting e-tendering, and shall be opened after opening and verification of documents in First cover.

**Both the covers are to be placed in a single third cover**

**The hard copies are to be submitted in 2 sets marked “ORIGINAL “and “COPY”, and are to be submitted within the cut off time and date in the office of Dy. Chief Engineer, (CED,PD,EP), Civil Engineering Division, 2nd Floor, Saarathi Building, Nuclear Fuel Complex, Hyderabad-500062, India.**

**Part -II(Financial/Price Bid)**:

Bid document should be uploaded after filling rates. No hard copy is required to be submitted

Issued to : \_\_\_\_\_

(Contractor)

Signature of officer issuing the documents \_\_\_\_\_

Designation: \_\_\_\_\_

Date of Issue: \_\_\_\_\_

**TENDER**

I / We have read and examined the Notice Inviting Tender, Salient Governing Features of the Tender /Work including Schedules A, B, C, D, E & F, Drawings and Designs, General Rules & Directions, General Clauses of Contract, Special Clauses of Contract & other documents and rules referred to in the Conditions and Clauses of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for the execution of the work specified for the President of India within the time specified in Schedule “F”, viz., Schedule of Quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in Rule 1 of General Rules & Directions and in Clause - 11 of the General Clauses of Contract

and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

I/We agree to keep the tender open for **one hundred twenty (120) days** from the last date of its submission of tenders and not to make any modifications in its terms and conditions.

A sum of **Rs. 70220/-** (Rupees seventy thousand two hundred and twenty only) has been deposited in cash/receipt treasury challan/deposit at call receipt of scheduled bank/ fixed deposit receipt of scheduled bank/ demand draft of scheduled bank 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 President of India or his successors in office 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 President of India or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said performance guarantee. I agree to carry out such deviations as may be ordered, up to maximum of the percentage mentioned in Schedule "F" and those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form. Further, I / We agree that in case of forfeiture of earnest money or Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

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

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.

**Signature of Contractor**

Postal Address

**Dated** \_\_\_\_\_

**Witness:**

**Address:**

*Occupation:*

**Tender No. E/527/2017**

**Tender for the work : Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.**

### **ACCEPTANCE**

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the President of India for a sum of Rs. \_\_\_\_\_ (Rupees \_\_\_\_\_ )

The letters referred to below shall form part of this Contract Agreement:-

- a)
- b)
- c)

For & on behalf of the President of India

\*Signature \_\_\_\_\_

Dated \_\_\_\_\_

\* Designation \_\_\_\_\_

**\*Will be filled by NFC.**





**Fill this form in Excel format attached in Technical Bid**

**FORM 'A'**

**DETAILS OF ALL WORKS OF SIMILAR CLASS COMPLETED DURING THE LAST SEVEN YEARS**

S. No.	Name of work/Project and location	Owner of sponsoring organization	Cost of work in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation /arbitration cased pending /in progress with details*	Name and address/telephone number of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

\* indicate gross amount claimed and amount awarded by the Arbitrator

**Signature of Bidder (s)**

With date & seal

**Fill this form in Excel format attached in Technical Bid**

**FORM 'B'**

**PROJECTS UNDER EXECUTION OR AWARDED**

S. No.	Name of work/Project and location	Owner of sponsoring organization	Cost of work in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Up to date percentage progress of work	Slow progress if any and reason thereof	Name and address/telephone number of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

**Signature of Bidder (s)**  
With date & seal

**FINANCIAL INFORMATION**

- I. **Financial Analysis** – Details to be furnished duly supported by figures in balance sheet /profit & loss account for the last five years duly certified by the chartered accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Financial Year	Years			
	Turn over	Profit/loss	Supporting document enclosed (Yes/No)	Remarks

- (i) Gross annual turnover on construction works
- (ii) Profit /Loss

- II. Financial arrangements for carrying out the proposed work
- III. Solvency certificate from Bankers of the bidder in the prescribed Form ‘D’.

**Signature of Bidder (s)**  
With date & seal

Signature of Chartered Accountant with Seal

**(Solvency certificate)**

This is to certify that to the best of our knowledge and information that M/s. /Shri.  
..... having marginally noted address, a customer  
of our bank are/is respectable and can be treated as good for nay engagement upto a limit of Rs. ....  
(Rupees .....only.)

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

**(Signature)**  
For the Bankers

Note: Bankers certificates should be on letterhead of the Bank, sealed in cover.

**Fill this form in Excel format attached in Technical Bid**

**FORM 'E'**

**DETAILS OF CONSTRUCTION PLANT AND EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THE WORK**

S. No.	Name of equipment	Nos.	Capacity or type	Age	Condition	Ownership status			Current location	Remarks
						Presently owned	Leased	To be purchased		
1	2	3	4	5	6	7	8	9	10	11

**Signature of Bidder (s)**

With date & seal

**Fill this form in Excel format attached in Technical Bid**

**FORM 'F'**

**DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE EMPLOYED FOR THE WORK**

Sl. No.	Designation	Total number	Number available for this work	Name	Qualifications	Professional experience and details of work carried out	How these would be involved in this work	Remarks
1	2	3	4	5	6	7	8	9

**Signature of Bidder (s)**  
With date & seal

**STRUCTURE & ORGANIZATION (GENERAL DATA)**

1. Name & address of the bidder:
2. Telephone No./ Telex no./ Fax no.
3. Legal status of the bidder (attach copies or original document defining the legal status)
  - (a) An individual
  - (b) A proprietary firm
  - (c) A firm in partnership
  - (d) A limited company or corporation
4. Particulars of registration with various Government Bodies (attach attested photocopy)

Organization / place of registration	Registration No.
1.	
2.	
3.	
5. Names and titles of Directors & officers with designation to be concerned with this work.
6. Designation of individuals authorized to act for the organization
7. Was the bidder ever required to suspend construction for a period of more than six months continuously after he commenced the construction? If so, give the name of the project and reasons of suspension of work.
8. Has the bidder, or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.
9. Has the bidder, or any constituent partner in case of partnership, firm ever been debarred/ black listed for tendering in any organization at any time? If so, give details.
10. Had the bidder, or any constituent partner in case of partnership firm, ever been convicted by the court of law? If so, give details.
11. In which field of civil Engineering construction the bidder has specialization and interest?
12. Any other information considered necessary but not included above.

**Signature of Bidder (s)**  
With date & seal

**COMPLIANCE TO BID REQUIREMENT**

**WORK:**                    **Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.**

**TENDER NOTICE NO.:E/527/2017**

We hereby agree to fully comply with, abide by and accept without variation, deviation or reservation all technical, commercial and other conditions whatsoever in the BIDDING DOCUMENT for the subject work.

**SIGNATURE OF BIDDER**                    :            \_\_\_\_\_  
**With date**

**NAME OF BIDDER**                         :            \_\_\_\_\_

**COMPANY SEAL**                            :            \_\_\_\_\_



**BRIEF SCOPE OF WORK**

Supply, installation, testing and commissioning of approved make air handling units, air cooled condensing units along with associated refrigerant piping, ducting, control panel, MCBDB, thermal insulation, acoustic insulation, electrical cabling etc as per the detailed technical specifications and schedule of quantities.

**LETTER FOR SUBMISSION OF BID**

(To be submitted by bidders on their letter head)

Date: -----

To  
Dy. Chief Engineer (CED,PD,EP),  
Civil Engineering Division, 2<sup>nd</sup> Floor  
Saarathi Building, Nuclear Fuel Complex,  
ECIL Post, Hyderabad-500062, AP, India

Our Ref. : \_\_\_\_\_

Tender Notice No.:

Name of work: \_\_\_\_\_

Dear Sir,

Please find herewith our Bid for the subject work **in two Parts (Part-I: Pre-qualification Bid & Techno-Commercial Bid, Part-II: Financial Bid)** in line with the requirement of the Tender Document. We confirm that:

1. **Our Bid contains Envelope-I which intern consists of Envelope A which includes EMD** in the form and of requisite value as specified in **NITand Transaction Fee** for Tender Processing, and **Envelope-B** which includes documents related to **pre-qualification criteria as per para 10 & Techno – Commercial documents.**
2. **We have submitted a no-deviation bid.** We understand that in the event of our taking any deviation, our Bid may not be considered for further evaluation.
3. We have submitted **our Bid as an Individual**
4. We further confirm that we will complete the work in totality as agreed and confirmed as per terms and conditions of the Tender document.
5. Our Bid is in complete compliance with all technical as well as commercial requirements of Tender document including Addendum/Corrigendum No. \_\_\_\_ (if applicable) and there is no technical or commercial deviation in the Bid.
6. We also confirm that our price shall remain FIRM for the entire Contract period, unless there is specific provision for adjustment in price as per terms and conditions of the Tender document.
7. We have submitted all documents as stipulated in NIT and various sections of the Tender document/ Technical specifications.
8. The validity of our Bid shall be **120 Days from the final bid due date of submission of Envelope-1.** We also confirm that if our bid validity period is to be extended on a later date for a reasonable period, on written request from NFC, we shall suitably extend the bid validity period without any financial implication until there is change in terms and conditions/Scope of work etc.
9. We also confirm that in the event of award of work to us, we shall submit performance bank guarantee for execution of work as per terms and conditions of the Tender document in NFC approved format.
10. We also confirm that in the event of award of work to us, we shall faithfully execute the Contract as per terms and conditions of the Tender/Contract document.

We declare that all statements made and information submitted by us in our Bid is true and complete to the best of our knowledge and belief and nothing is concealed.

Bidder's signature :  
Name :

Designation :  
Mobile (with STD Code):  
Email :  
Full Address (for all future communication):  
Company Seal :

**Note:** Bidder to note that:

1. All the pages of bids are to be signed by the authorised signatory (having power of attorney (POA)).
2. All correspondence with NFC shall be made by the POA holder.

(To be submitted by bidders on their letter head)

Appendix-IV

**DECLARATION BY THE CONTRACTOR**

Tender in two envelope system Part-I (Technical Bid) and Part-II (Financial Bid) for the work of **Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.** Tender Notice No. E/527/2017

I/We have read and examined the detailed notice inviting tender, schedule, A, B, C, D, E & F. Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Rate & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the President of India within the time specified in Schedule ‘F’, and schedule of quantities in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of contract and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

I/We agree to keep the tender open for One hundred and Twenty (120) days from the due date of submission and not to make any modifications in its terms and conditions.

A sum of **Rs.82,000/-** has been deposit in cash/receipt treasury challan / Demand Draft/Pay Order/Fixed Deposit Receipt/Banker’s Cheque/ Deposit at call Receipt of a Scheduled Bank as earnest money. **If I/We fail to furnish the Performance Guarantee within prescribed period specified, I/we agree that the said President of India or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money deposit.** Otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, up to maximum of the percentage mentioned in Schedule ‘F’ and those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form.

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.

**I/We agree that should I/We fail to commence the work as specified, I/we agree that the President of India or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit EMD and performance guarantee absolutely, otherwise,** the same may at the option of the competent authority on behalf of the President of India be recovered without prejudice to any other right or remedy available in law out of the deposit in so far as the same may extend in terms of the said bond and in the event of deficiency out of any other money due to me/us under this contract or otherwise.

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

Dated \_\_\_\_\_  
Address \_\_\_\_\_

Signature of Contractor  
Postal \_\_\_\_\_

**Location and Access to site**

The site is located at Moula-Ali, Andhra Pradesh, about 13 km along motorable road from Secunderabad. The nearest railway station is Moula Ali which is 5 km away from Secunderabad (15 km from Hyderabad). On the way the Hyderabad-Kazipet broad gauge line of South Central Railway. The Hyderabad-Kazipet line runs just south of the area acquired by Department of Atomic Energy.

The climate conditions at Moula-Ali are similar to those prevailing at Hyderabad and are generally as indicated below:

Max. of mean daily Temperature	: 40°C
Min. of mean daily Temperature	: 13°C
Absolute max. Temperature	: 45°C
Absolute min. temperature	: 8°C
Relative Humidity max	: 83%
Relative Humidity min	: 27%
Average yearly precipitation	: 750 mm
Maximum daily precipitation	: 150mm
Maximum Hourly precipitation	: Not available
Maximum wind velocity	: 84km/hr
Wind direction	: May to September mainly from W&NW Rest of the year mainly from NE, E and SE

The site is well connected to Hyderabad-Secunderabad by road. The Hyderabad-Kazipet broad gauge line passes just south of the site and a private siding has also been taken to NFC. Hyderabad has a commercial airport at Shamshabad (25 km from Hyderabad) and direct flights are available from all major cities. Both Chennai and Mumbai serve as Seaports for Hyderabad.

**Post, telephone and fax facilities are available. Site office address is:**

Office of the  
Executive Engineer  
Electrical Projects (Ventilation)  
Nuclear Fuel Complex  
Department of Atomic Energy  
ECIL post, Hyderabad-500062  
Telephone: 040-27184344, 4469  
Fax : 040 -27122532

**Proforma schedules (A to F)**  
Notice inviting e-Tender No. E/480/2015

<b>SCHEDULE 'A'</b>
<b>Schedule of quantities (Financial Bid) – Uploaded in Excel format</b>

<b>SCHEDULE 'B'</b>		Schedule of materials to be issued to the contractor		
S. No	Description of item	Quantity	Rates at which the materials will be charged to the contractor	Place of issue
1	2	3	4	5
1	Water for construction Purpose	As required	Free	at work place
2	Electricity for construction purpose	As required	Free	at work place

<b>SCHEDULE 'C'</b>	Land earmarked for temp. infrastructures and Tools & plants to be hired to the contractor		
S. No	Description	Hire charges	Place of issue
<b>NOT APPLICABLE.</b>			

<b>SCHEDULE 'D'</b>	Extra schedule for specific requirements / document for the work, if any Particularly for addl Security guidelines, Gate pass, lift, tower crane etc.		
	See Special Clauses of Contract.		

<b>SCHEDULE 'E'</b>	Reference to "Conditions & Clauses of Contract" to be followed for this work : <b>As uploaded</b>		
<b>Name of Work:</b>	<b>Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.</b>		As per NIT
Estimated cost of work	Rs 35.11 Lakhs		As per NIT
(ii) Earnest money (to be returned after receiving performance guarantee)	Rs 70220/-		As per NIT
(iii) Performance Guarantee	5% of tendered value		As per Tender
(iv) Security Deposit	2.5% of tendered value		As per Tender

<b>SCHEDULE 'F'</b>	<b>GENERAL RULES &amp; DIRECTIONS:</b>		
Tender Inviting Authority:	<b>Dy. Chief Engineer (CED, PD &amp; EP)</b>		
Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 & 12.3.	Refer Clause 12 in foregoing paras.		

<b>Definitions:</b>	
2(V)	Engineer-in-Charge <b>Superintending Engineer</b>

		<b>(VP,AC&amp;R), Electrical Projects</b>
2(Viii)	Accepting Authority	<b>CE, NFC</b>
2(x)	Percentage on cost of materials and labour to cover all overheads and profit	<b>15% (Fifteen percent)</b>
2(xi)	Standard Schedule of Rates	<b>Prevailing Market rates</b>
2 (xii)	Department	<b>Nuclear Fuel Complex, Department of Atomic Energy.</b>
9(ii)	Standard Contract Form of Dept.	<b>Item Rate Tender</b>

<b>Clause 1</b>	
i) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance	<b>15 days</b>
ii) Maximum allowable extension with late fee @0.1% per day of the performance guarantee amount beyond the period provided in (i) above	<b>15 days</b>

<b>Clause 2</b>	
Authority for fixing compensation under Clause 2	<b>Chief Executive, NFC</b>

<b>Clause 2A</b>	
Insensitive for early completion.	<b>Not Applicable</b>

<b>Clause 5</b>			
Number of days from the date of issue of letter of acceptance/WO for reckoning date of start			<b>15 days</b>
Time allowed for execution of work			<b>8 (Eight) months</b>
<b>Table of Mile Stone(s)</b>			To be submitted by the party taking into consideration completion period of work.
Sl. No	Description of Milestone (Physical)	Time allowed in days (from date of start)	Amount to be with-held in case of non achievement of milestone
1	Nil		Nil
2	Nil		Nil
Authority to decide:			
(i) Extension of time			Engineer in-charge
(ii) Rescheduling of mile stones			Dy. Chief Engineer (CED, PD & EP), NFC.

<b>Clause 6, 6A</b>	
Clause applicable – (6 or 6A)	Clause 6 applicable

<b>Clause 7</b>
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Gross work to be done together with net payment / adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment.	More than Rs3 lakh
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------

<b>Clause 10 A</b>		
List of testing equipment to be provided by the contractor at site lab (The list given below is indicative)		
1. Thermo Anemometer	2. Micrometer	3. Electric Multi-meter
4. All other equipments required for testing and commissioning of AC system.		

<b>Clause 10B (i) &amp; (ii)</b>	
Whether Clause 10B (i) shall be applicable	<b>Yes</b>
Whether Clause 10B (ii) shall be applicable	<b>No</b>

<b>Clause 10C</b>	
Component of labour expressed as percent of value of work	<b>Not Applicable</b>

<b>Clause 10CA:</b>	<b>Not Applicable</b>
Nearest Material for which all India wholesale Price Index is to be followed and Basic price	

<b>Clause 10CC:</b>	<b>Not Applicable</b>
Clause 10CC to be applicable in contracts with stipulated period of completion exceeding the period shown in the next column	06 Months

<b>Clause 11</b>	
Specifications to be followed For execution of work	NFC Tender Specifications/ CPWD specifications/ AERB Regulations/ IS codes

<b>Clause 12</b>		
12.2 & 12.3	Deviation limit beyond which clauses 12.2 & 12.3 shall apply for HVAC works.	<b>30%</b>
12.5	Deviation limit beyond which clauses 12.2 & 12.3 shall apply for foundation work	<b>NA</b>
12.5	Deviation limit beyond which clauses 12.2 & 12.3 shall apply for maintenance work	<b>NA</b>

<b>Clause 16</b>	
Competent Authority for deciding reduced rates	Chief Executive, NFC

<b>Clause 18</b>	
List of mandatory machinery, tools & plants to be deployed by the contractor at site :	



1. Tool Kit	2. Drilling machine	3. Welding machine
4. Crane / lifting machinery	5. Ropes	6. Crimping tools
<b>Note:</b> The list of machinery, tools & plants to be deployed by the contractor at site are bare minimum. The contractor shall deploy additional machinery, tool & plants in order to maintain the progress of the work without any extra cost to the department.		

<b>Clause 36(i)</b>						
<b>Requirement of Technical Representative(s) and recovery rate</b>						
Sl. No	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical representative)	Min Exp in yrs	No	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i)
1	Graduate Engineer/ Diploma Engineer	Mechanical/ HVAC	Principal Technical Representative	2 years for Graduate and 5 years for Diploma Engineer	1	Rs 15000/- (Rupees Fifteen Thousand only)
2	Degree/Diploma/ITI holder in engineering or science stream	Any science/ engineering stream	Safety Supervisor	3 years	1	Rs 10000/- (Rs Ten Thousand only)
Note: Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers.						

<b>Clause 42:</b>	<b>Not Applicable</b>
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Statement of Wages: The minimum rate of daily wages payable to an employee employed on daily wages shall be as under:		
Sl.No	Category	Daily wages payable
1	Highly Skilled Labour	Rs 653/-
2	Skilled Labour	Rs 593/-
3	Semi-skilled Labour	Rs 506/-
4	Unskilled Labour	Rs 448/-

**Nuclear Fuel Complex**  
**DETAILED TENDER SPECIFICATIONS**

**FOR**

**Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.(Tender No: E/527/2017)**

**1. GENERAL:**

- 1.1 These specifications cover “**Supply, Installation, testing and commissioning of AC System consisting of air handling units, air cooled condensing units,GI ducting, grilles, dampers, thermal insulation, acoustic insulation, associated supporting structure and required electrical items such as cables, trays &MCC panel etc for Control Lab at NFC, Hyderabad**”.
- 1.2 All items mentioned in these specifications shall be complete in all respects and any component or, equipment not covered here but essential for proper design, operation and maintenance shall be brought to the notice and included by the bidder. The successful bidder shall take full responsibility for the guaranteed operation of the system, as regards performance/reliability etc.
- 1.3 No foreign exchange or, import license for importing equipments, components, spares or, raw materials against these specifications will be arranged or, provided by the department. It shall be the responsibility of the bidder for the supply of materials from Indian and foreign sources as the case may be, and execute the contract within the agreed time schedule. In case, the offer involves expenditure in foreign exchange this fact shall be clearly indicated by the bidder together with a statement as to how this will be arranged by the bidder.
- 1.4 Where found necessary, the department reserves the right to select reputed manufacturers for any of the items, in the interest of the standardization, and therefore, the successful bidder shall supply the same of the particular make, if so required. It may be noted that the items of supply included in the scope of this tender shall be of standard make, or from reputed manufacturers subject to approval of the department.
- 1.5 The location, climatic conditions etc., of the site and access to the site are indicated under clause (2) of “Special clauses of contract (SCC)” are provided in Appendix V along with NIT.
- 1.6 The Nuclear Fuel Complex area slopes from the ridge of hills on the west towards the east, the levels dropping by about 11 M in distance of 400 M. The altitude above MSL is around 538 M.

**2.0 STANDARDS:**

- 2.1 Unless otherwise specified, the equipments/components shall be designed, assembled, erected and tested in accordance with the relevant **IS** codes published by

the Bureau of Indian Standards, wherever available, in order that specific aspects under Indian conditions are taken care of. In case, where suitable Indian standards are not available, the item(s) shall conform to the generally accepted codes and practices.

2.2 The electrical equipments & installation shall also conform to the latest Indian Electricity Rules, as regards safety, earthing and essential provisions specified therein for installation and operation of electrical equipments.

2.3 All the items included in the scope of this tender shall comply with the statutory requirements (if any) of the Government of India as well as the Government of Telengana. The entire equipment & installation shall also conform to the provisions of statutory and other regulations in force, such as the Indian Factories Act, Indian Explosives Regulations etc., whichever may be relevant to the items of works called for in this tender. The successful bidder at no extra cost, if so required, shall arrange approval on drawings and/or, installation by the statutory authorities.

2.4 In case, where the offer deviates from the specified standards, the bidder shall indicate clearly in his offer the standards proposed to be adopted by him along with the details thereof.

### 3.0 **WORKMANSHIP:**

All items covered in the specifications shall be manufactured from the best materials under best manufacturing practices and workmanship.

### 4.0 **LUBRICATION:**

All equipments shall be provided with efficient lubrication arrangement so that bearings and other parts are not subjected to under wear and tear. Sufficient lubrication point shall be provided, wherever necessary and all such points shall be easily accessible. The bidder shall indicate the name of the lubricant and quantity required thereof for a period of one (1) year.

### 5.0 **SAFETY:**

5.1 All moving and exposed parts shall be adequately guarded to prevent accidents to the operators and other working in the vicinity.

5.2 The successful bidder (i.e., the contractor) shall undertake to bear the primary responsibility for the safety of the contract labourers and others who shall accompany them (including children). The contractor shall have to make necessary arrangements to ensure their safety. The successful bidder, immediately after awarding the contract shall, therefore, furnish a written undertaken to the department to that effect.

5.3 The contractor shall ensure completion of the entire work under safe working conditions, as per "SAFETY CODE" prevailing at NFC.

### 6.0 **UTILITIES:**

Power Supply: Three phase, 415/240 V, AC 50 Hz power supply will be available.

#### 7.0 **MISCELLANEOUS:**

Work related minor civil works, as may be required for erection of ducting etc. shall be carried out by the contractor, e.g., making openings holes for duct passage, drilling, chipping/grouting and making good after erection, etc.

#### 8.0 **CODES, STANDARDS AND REGULATIONS:**

- Generally all works under this contract shall be complied with the following Indian Standards of latest version.
- The contractor shall make available copies (upon Award of Contract) of the above standards for reference of the Owner.

#### **HVAC EQUIPMENT:**

IS 659 Safety Code for air conditioning.

IS 660 Safety Code for mechanical refrigeration.

IS 3103 Code of practice for Industrial Ventilation.

IS 3483 Code of practice for noise reduction

IS 5111 Testing of refrigeration compressors

IS 3615 Glossary of terms used in refrigeration & air conditioning

IS 520 standard for positive displacement refrigeration, compressor and condensing unit.

IS 2825 Unfired pressure vessels

IS 4503 Shell and tube type heat exchanger.

IS 7896 Data for outside design conditions for air conditioning

IS 10617 Thermostats for use in refrigeration, air conditioners etc.,

IS 8148 Packaged air conditioners

IS 10594 Thermostatic Expansion Valve

SP 7 National Building Code (Group 4)

IS 12065 Permissible limits of noise level for rotating electrical machines.

IS 4578 Lubricating oils for refrigeration machinery

IS 10609 Refrigerants - Number - Designation

IS 4894 Centrifugal Fans

IS 2264 Preferred frequencies for acoustical measurements.

IS 11446 Measurement of air borne noise emitted by compressors units intended for outdoor use.

IS 12710 Glossary of terms used in acoustic emission testing.

IS 4758 Methods of measurement of noise emitted by machines

#### **ELECTRICAL:**

IS 325 Three phase induction motors (IS 1231 foot & IS 2223 Flange mounted)

IS 1822 Motor starters of voltage not exceeding 1000 V

IS 3043 Earthing and earth station

IS 2147 Degree of protection provided by enclosures for low voltage switch and control gears.

IS 900 installation of motors

IS 3012 Code of practice for installation (Part-I) & maintenance of switch gear

IS 996 Single phase small AC and universal motors

IS 732 Code of practice for electrical wiring and fittings for buildings

IS 2516 AC circuit breakers for voltage not exceeding 1000 volts

IS 4064 & IS 4047 Heavy duty air break switches and composite units of air break switches and fuses not exceeding 1000 volts  
IS 2208 HRC cartridge fuse links up to 650 volts  
IS 1554-Part I PVC insulated ( heavy duty) electric cables for working voltage up to and including 1100 volts.

**SHEET METAL WORKS:**

IS 277 Galvanized Steel sheet  
IS 655 Metal Air ducts  
IS 513 Cold rolled low carbon steel sheets.

**THERMAL INSULATION :**

IS 3069 Glossary of terms, symbols & units relating to thermal insulation materials  
IS 3346 Method of determination of thermal conductivity of thermal insulation materials  
IS 4671 Expanded Polystyrene for thermal insulation purposes  
IS 661 Code of practice for thermal insulation of cold storages  
IS 7240 Code of practice for application and finishing of thermal insulation.  
IS 7413 Code of practice for application material at temp. from 80° C to 40° C & finishing of thermal insulation material at temp. from 40° C to 700° C.

**SAFETY CODES:**

IS 660 Safety code for mechanical refrigeration  
IS 659 Safety code for air conditioning  
IS 3016 Code of practice for fire precautions in welding and cutting operations  
IS 818 Code of practice for safety and health requirements in electrical and gas welding and cutting operations  
IS 5216 Code of safety procedures and practice in electrical works  
IS 3696 Safety codes for scaffolds and ladders.

**INTERNATIONAL STANDARDS:**

SMACNA HVAC Systems - Duct Design  
SMACNA HVAC Air duct leakage test manual  
SMACNA HVAC duct construction standards - Metal & flexible  
SMACNA Rectangular duct construction  
SMACNA Round duct construction  
SMACNA Energy conservation guidelines.  
SMACNA Energy recovery equipment and systems, air to air  
SMACNA HVAC Systems - Testing, adjusting & balancing

**ASHRAE / ISHRAE Handbooks**

ASHRAE Gravimetric & Dust spot procedures for testing air cleaning devices used in general ventilation for removing particulate matter. - 52.1  
ASHRAE Methods of testing liquid chilling packages.  
ASHRAE Number designation & safety classification of refrigerants  
ASHRAE Practices for measurement, testing & balancing of building, heating, ventilation & air conditioning system.  
ASHRAE Ventilation for acceptance indoor air quality-62.1-2007  
ASHRAE Commissioning of HVAC Systems.

ASHRAE Methods of testing liquid chilling packages as per ASHRAE 30 Latest Standard  
ASHRAE Thermal environmental conditions for human occupancy-55  
ASHRAE Energy Standard for Buildings except Low-rise Residential Buildings -90.1  
UL-555 Fire Dampers  
ANSI Scheme for identification of piping system  
ARI Rotary Screw Chilling Package ARI 560 Latest  
AMCA Laboratory methods for testing fans for rating as per ANSI / AMCA 210  
CARRIER System Design Manual.

NOTE: All works performed and equipments and materials supplied under this contract shall comply in every respect with the Rules and Regulations of the Local Authorities including but not limited to :

- Energy Conservation Building Code - ECBC.
- Electrical supply and inspection regulation
- Fire Regulation & Machinery regulation.
- National Environmental Regulation (NER)
- National Fire Protection Association (NFPA)
- The factory Act.

#### 9.0 DETAILED TECHNICAL SPECIFICATIONS AND TESTING PROCEDURE OF THE IMPORTANT ITEMS AND WHOLE SYSTEM

The present scope of work involves installation of new AC system with AHU and air cooled condensing units and dismantling and shifting the present system. The proposed work consists of Supply, Installation, testing and commissioning of AC System consisting of air handling units, air cooled condensing units, GI ducting, grilles, dampers, thermal insulation, acoustic insulation, associated supporting structure and required electrical and control system items such as cables, trays & MCC panel etc.

#### **BASIS OF DESIGN:**

The system has been designed on the following basic design parameters; Bidder has to verify and cross check the design before quoting to meet the intended requirements.

#### Outdoor Design Conditions:

Summer: DBT 41.1 °C and WBT 25.6 °C

Monsoon: DBT 29.4 °C and WBT 27.2 °C

Winter: DBT 12.8 °C and WBT 8.9 °C

#### Inside Design Conditions:

Normal: 25 ±1 °C and RH 55%± 5%

Heater: 21±1 °C and RH 55%± 5%

Fresh Air: 2 air changes/hour

Heat Load Summary:

Cooling Load (Actual): 11 TR x 3

Dehumidified Air (Actual): 4400 x 3 CFM

Room Insulation: False ceiling.

The total estimated cooling load of 33 TR is to be achieved by 3 Nos.X 11 TR DX type Air handling units associated with 3 Nos X 11 TR air cooled condensers (twin or more compressors are not accepted).

The site is fully functional and is situated inside factory security zone. Hence the work has to be planned accordingly to avoid the inconvenience to the work. The bidder is requested to get firsthand information and site condition to access the scope of work.

**The technical specifications for the major items are as follows;**

9.1 **AIR HANDLING UNITS:**

***Scope of this section comprises of supply, installation, testing and commissioning of Air handling unit confirming to the specifications and in accordance with the requirement and of the Schedule of Quantities***

**GENERAL CONDITIONS:**

The air handling units shall be of continuous duty, industrial type, outdoor application, double skin construction, draw through type in sectionalized construction consisting of blower section, cooling coil section, heating section, filter section, mixing box and insulated drain pan. Unless otherwise specified, the unit shall be horizontal type.

**CASING:**

The casing shall be sandwiched type double skinned construction with insulation between the two sheets/ skin. The panels shall be of 45 mm thick made of ALUZINC (Al 55%, +Zinc 43.4% +Si 1.6%) coated steel of 0.6 mm thick, PUF insulation and shall be fixed to 2.5 mm thick anodised aluminium alloy thermal break profiles frame work with stainless steel screws/ snap in connections. The PUF insulation shall be 40 kg/m<sup>3</sup> CFC free. Outer sheet of panels shall be pre-painted / pre-plasticised. Aluminium profiles shall be internal round corners to avoid accumulation of dust. The main framework shall be extruded aluminium hollow structural sections. The entire framework shall be assembled using mechanical joints to make a sturdy and strong framework for various sections.

The housing shall be so made that it can be delivered at site in total / semi knocked down condition, depending upon the requirements.

Minimum 450 mm access door shall be provided for easy access to filters, coils, fans etc. Each access door shall be provided with easy release 90<sup>0</sup> turn nylon handles and GM Chrome plated locks. Hinges shall be heavy-duty die cast solid aluminium with SS pivots. A safety "trip-switch" shall be provided to automatically cut off the electrical supply to the fan when any access door is opened. The inspection doors shall have neoprene/ EPDM rubber T-section, rubber seals, hinges and locking arrangements. The gaps between filter frames and housing shall have synthetic rubber packing, to eliminate any air leakage. All filter frames shall be epoxy painted. The flat filter section shall be suitable for mounting filters vertically.

The casing shall be sectionalised construction, consisting basically of individual fan section, heater section, coil section, filter section, mixing box section and drain pan. Sections shall be joined with continuous gasketing to form an air tight enclosure. The coupling of adjacent sections is to be secured by the use of galvanized lap connectors. The panels shall be fastened to the frame work by means of thread cutting sheet metal screws and shall be sealed against

air leakage by the use of continuous neoprene/ EPDM gasket of 3 mm minimum thick. Protection shall be in the form of a "U" shaped panel edge or in the form 15mm channels fixed to the inside surface of each panel.

The casing shall be fixed to rigid/ rugged independent galvanised structural steel base frame properly reinforced and braced with intermediate cross members with lifting holes for installation. The frame work shall be constructed from minimum 3 mm thick, galvanised structural steel of rolled shapes or die formed shapes.

For casing sound absorption i.e. to cushion the propagation of the sound wave coming from the unit through the air ducts, inside panel skin area of heating and fan sections shall be provided/ finished with 25 mm thick open cell elastomeric foam of density 140 - 180 kg/m<sup>3</sup> and fire rating CS3d0 - EN13501. The fan shall be selected considering low noise application.

The AHU shall be certified in accordance to EN 1886 -2007

Casing strength: class D1

Casing air leakage at -400 Pa: class L2

Casing air leakage at +700 Pa: class L2

Filter bypass leakage: class F6

Thermal transmittance: class T2

Thermal bridging factor: class TB2

Sound attenuation Rw (DIN 52210-03): 34 dB

#### **FAN:**

Fan section shall comprise of heavy duty centrifugal fan, backward curved, double inlet double width type. The fan outlet velocity shall not exceed 9.1 m/s. The fan shall meet the external static, which may be required for supply and return air distribution. Fan casing and wheel shall be made of galvanized/MS steel sheet. The impeller & fan shaft shall be statically and dynamically balanced. The fan impeller shall be mounted on a solid shaft supported on angle iron with heavy duty Tapered bore bearing Double row, self-aligned with grease fittings piped for easy access. The fan bearings shall not be mounted on the fan scroll/AHUs casings but shall be mounted on **independent pedestals**. The bearings shall have an average life of 200,000 hours at design operating conditions per ANSI code B3.15. Fans shall be of approved make only.

Motors shall be mounted inside the AHU casing on slide rails for easy self-tensioning. Both fan and motors shall be complete with multi 'V' belt drive and the assembly shall be mounted on integral base frame made from deep section aluminium alloy. Isolation shall be provided from the unit casing by combination of spring or anti vibration rubber mounts. The fan outlet shall be connected to casing with the fire retardant double canvas. The opening for the access of the fan section shall be provided with micro-switch and galvanized iron mesh.

Rotating assembly shall be certified as resulting from tests performed in accordance with the standard test codes adopted by AMCA BV-3.

#### **MOTOR AND DRIVE SET:**



The fan motor shall conform to IS:325 - 'Three phase induction motors' and shall be suitable for 415V +10%, 50 Hz, 3 phase, AC supply. It shall be squirrel cage, totally enclosed fan cooled with Class F insulation and EFF2 rating. Motors shall be specially designed for quiet operation and motor speed shall not exceed 1450 RPM. Motors shall be connected to an electrical panel consisting of starters, isolators, ELCB, etc.

Drive to fan shall be provided through belt-drive with a standard belt guard housing the bolt and adjustable motor sheave. Belts shall be of heavy duty anti-static V-belt, constant pitch, suitable for 110% of motor power. Drive sheave dimensions and belt number shall be sufficient to transmit the required power to the driven equipment with an efficiency of not less than 95 %. Drives shall have a service rating of 140 % of the maximum estimated load. Reinforced tachometer access openings shall be provided.

#### **HEATER:**

Supply and Fixing of Heater bank of adequate capacity with necessary insulators and wiring along with Humidistat, Thermostat. Fixing to be done inside the AHU.

#### **COOLING COILS:**

The DX cooling coils shall be as per manufacturer's standard or be constructed from 9.53mm OD (3/8") - 27 SWG round seamless internal grooved copper tubes combined with mechanically bonded 37 SWG Aluminium mild rippled fins of 12 FPI and die formed directional guide channels and assembled within frame work made from galvanised sheet of 1.6 mm minimum thickness. Intermediate centre supports shall be provided for all coils exceeding 1.37 meters in length. The bends shall be ready made with solder rings on both ends.

The cooling coil shall be integral and intertwined construction with minimum 6 rows along with distributors to cater 3 condenser circuits. Cooling coil shall be suitably sized to provide the required cooling capacity as specified elsewhere in this tender. Coils shall be provided in the capacity, quantity and arrangement for each air handling unit as per manufacturer's selection data to suit the particular specification for the cooling coils. The tubes shall be staggered in the direction of air flow.

Coils shall be mounted on tracks of structural steel and shall be removable from either end of the unit without dismantling or unbolting any sections of the air handling units, other than the coil access panel.

Coil headers shall be completely enclosed within the insulated coil casing section. The inlet and outlet connections shall be extended a minimum of 150mm beyond the exterior of the coil casing through pre-cut openings. Sealing collars shall be provided at the openings for the coil connections.

Cooling coils shall be pressure tested to suit working pressure of refrigerant i.e. 28bar. Coil surface area shall be such that the average cross sectional air velocity in the coil plenum is no more than 125 m/min.

The coil shall be compliant for performance rating as per AHRI 410 -2005.

Cooling coil shall be complete with drain pan constructed from stainless steel sheet and shall be installed inside the double skin panel to avoid condensation or can be double skin tray with inside 18G SS-304 and outside with 24G GI (sandwich type) along with 25 mm PUF insulation in between to be provided. The drain pan shall be at least 500 mm wide sufficiently extended to collect all condensate with sloping sides for quick drain. The drain pan shall be fitted with drainage coupling on both sides.

**CONDENSATE DRAIN PIPING:**

Drain Pipe shall be used to remove condensate from evaporator unit to drain point. CPVC pipe of size NB 40 mm, wall thickness 3.8 mm shall be used. The joints shall be properly sealed so that there is no water leakage. U trap shall be provided at the end.

**THERMOSTATIC EXPANSION VALVES:**

Each cooling coil shall be provided with its thermostatic expansion valve with external equalization to ensure that specified accuracy of temperature control of the system can be achieved. No valve shall operate 35% below its rated capacity. The expansion device shall be suitable for a maximum operating pressure of refrigerant used. Expansion valve bulb shall be located immediately after the evaporator outlet on the suction line 45° above bottom of pipe or as per OEM recommendations.

**FILTER SECTION:**

Cleanable, non-flammable synthetic fibre filters 50 mm thick Pre filter section suitable for flanged M6 (EN779:2012) i.e. average efficiency for 0.4 µm particle shall be 60 to 80% shall be used (Equivalent to 99% down to 5µm particle). The filter shall be high energy efficient type as per Eurovent compliant. The average efficiency Velocity through the filters shall not exceed 1.8 m/s. The final pressure drop through dirty filter is 45 mm WG.

**DAMPERS:**

Blades shall be made of double skinned aerofoil aluminium extruded sections with integral gasket and assemble with rigid extruded aluminium alloy frame. The movement shall be opposed type and moved through ABS gears protected from the airflow. Manual dampers shall be provided with a Bakelite knob of locking the damper blades in positions. Air leakage through dampers when in the closed position shall not exceed 1.5% of the maximum design air volume flow rate at the maximum design air total pressure.

**INSTALLATION:**

Floor mounted AHU's shall be installed on civil pedestals keeping rubber pads to avoid transmission of vibration to the floor. The contractor shall ensure that the complete installation is totally vibration free. AHUs shall be air tight without any leaks and shall be shown before commissioning. The unit shall be installed as per manufacturer's recommendations. Care should be taken that no panels are damaged or scratched. In case of damage or scratch, panel shall be replaced free of all cost to the Client.

The concrete foundations required for the AHUs shall be prepared by the vendor as per approved drawings. The Vendor shall supply all foundation bolts, base plate, vibration eliminators, etc. and shall ensure that all the above accessories are placed securely in proper position while the foundation is cast.

**SAFETY FEATURES:**

Each air handling unit shall have safety features as under:

- The access doors shall be equipped with micro switch interlocked with fan motor to enable switching off the fan motor automatically in the event of door opening.
- Pressure drop across filters shall be sensed and indication shall be provided for replacement/ cleaning of the filters.
- Fan and motor base shall have proper provision for earthing from the factory.
- All screws used for panel fixing and projecting inside the unit shall be covered with PVC caps to avoid human injury.

**PRE COMMISSIONING CHECKS:**

- Check the AHU's / Fans installed according to the specifications and design.
- Check the duct work is completed.
- Check the air filters are fixed and clean.
- Check the air terminals are installed as per the design.
- Check the dampers are installed and accessible.
- Check the duct work is cleaned internally.
- Check the test holes drilled for measurement.
- Check the FD's / VCD's are opened.
- Check the Grills and Diffusers are installed.
- Check the Fan chamber / unit are cleaned.
- Check the motor termination and control unit.
- Check the fuse rating is correct.
- Check the drain pipe and slope is correct.
- Check the direction of fan rotation is correct.
- Check the fan and motor are lubricated.
- Check the fan shaft and bearing are aligned properly.
- Check the Vbelts, drive guards and tension is correct and fitted.
- Check the static balance and adequate access to fan.
- Doors and Windows are fixed.
- Re circulation and air transfer opening size is correct.

**COMMISSIONING CHECKS:**

- Set the fan rpm to provide design total air quantity within acceptable limits.
- Fan speed shall not exceed the maximum allowable rpm as established by the fan manufacturer.
- Set all the main duct & branch duct dampers and outlet dampers at full open position.
- Check the total flow of the fan by duct traverse method, flow will be set to 105 % of design flow
- Check the flow in all branches and find out the index branch.
- Balance the branches in proportion with the same percentage of total flow by adjusting the volume control dampers and keeping the index branch dampers at fully open condition.
- Measure the index branch and proportionally balance the air terminals.

- The final setting of fan rpm shall not result in overloading the fan motor in any mode of operation.
- Dampers shall be modulated, and the ampere of the supply fan motor shall be measured to ensure that no motor overload can occur.
- After Total System Balancing, the following values shall be recorded:
  1. Fan rpm
  2. Motor voltage and current
  3. Entering static pressure
  4. Leaving static pressure.
- 5. Pressure drop across filters.

**TESTING & PERFORMANCE:**

Cooling capacity of various Air handling unit models shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Flow measurements 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.

Air handling units shall be selected for the lowest noise level of the equipment as per the selection criteria. Fan performance rating and power consumption data with operating points clearly indicated shall be submitted with the tender and verified at the time of testing and commissioning.

The AHU, after completely assembled with the coil, will have to be run tested at site, to establish the following:

- a) Air Quantity.
- b) Power consumption.
- c) Static pressure.
- d) Noise and vibration.
- e) Control signal from fire alarm system.

**PERFORMANCE EVALUATION CHECKS:**

- Measure the Supply Air / Return Air / Fresh Air Volume in CFM / CMH
- Measure the External Static Pressure in kPa / Pa
- Measure the Fan RPM / Motor RPM
- Measure the Voltage / Amperage
- Measure the On Coil / OFF Coil Temperature in °C / °F

9.2 **AIR COOLED CONDENSING UNIT:**

**Scope:** Scope of this section comprises of the supply, installation, testing and commissioning of Air-cooled Condensing Unit confirming to the specifications and in accordance with the requirement and of the Schedule of Quantities.

**GENERAL CONDITIONS:**

Nominal Capacity of Condensing unit: 11TR (+/-) 10%. The construction, production, type and testing of DX Air cooled Condensing unit shall conform to latest IS standards. Number of compressors shall be one only.

Air-cooled condenser shall be with single or multiple coils of minimum 3 rows deep. The copper tube not less than 7 mm dia. and thickness as per ASTM B88 K-type shall be selected. The tube shall also be internally grooved. Fins shall be made of Aluminium of thickness 0.16mm having 13 fins per inch and the method of bonding of tubes & fins shall be mechanical expansion. Air cooled condenser shall have maximum surface area to ensure a good heat transfer across the coil. The surface of the condenser coil shall be coated with suitable chemical coating to prevent deterioration due to corrosive industrial climate.

The condensing unit shall be a factory-assembled unit housed in a sturdy weatherproof casing constructed from galvanized steel 1.2 mm thick and pure polyester powder coated panels. The cabinet shall be assembled with pop rivets providing ease of disassembly for routine service and installation work. Condensers shall be suitable for 24 hours operation and be capable of providing vertical or horizontal discharge. The Condenser fan blades shall be of Aluminium, propeller type direct driven, mounted with fan guard. The fan motor shall be equipped with double ball bearing. The motor shall have class 'F' insulation. The fan shall be dynamically balanced to ensure low noise and vibration free operation.

The compressors shall be hermetically sealed scroll compressor, suitable for 3phase 410V + 10%, 50Hz, AC power supply, with built-in overload protection, mounted on vibration isolator rubber mounts. The compressor shall be of the high efficiency complaint, with E.E.R (Energy Efficiency Ratio) of not less than 11.1 BTU<sub>h</sub>/Watt (C.O.P not less than 3.25) at AHRI rating conditions. All necessary safety devices shall be provided to ensure safe operation of the system and complete with crankcase heaters.

Sufficient valves shall be included to allow compressor to be removed for service & to allow the refrigerant to be pumped into and contained in the condenser. The unit shall be equipped with shut off valves for liquid line and gas line, filter drier, liquid line sight glass and solenoid valve. The unit shall have service valves at suction and discharge lines. The unit should be equipped with a highly efficient oil separation system to ensure stable operation with long refrigerant piping. The unit shall be provided with first charge of eco- friendly (R407C/410A) refrigerant and oil. The condenser shall balance the heat rejection of the compressor at 39<sup>0</sup>C ambient.

The noise level of the unit shall not be more than 70dB (A) measured horizontally 1 m away and 1.5 m above base level. However lower noise level units are **preferred**. All precautions to reduce noise and vibration transmission to be taken care. The entire unit shall be placed on neoprene ribbed pads of 6mm thickness and size 150 X 150 mm.

#### **MICROPROCESSOR CONTROLLER:**

The condensing unit shall have micro-processor based control system with a control panel, which shall house the complete electrical switch gear. The panel shall be kept away from condensing unit (condensing units mounted on roof top) near to MCC adjacent to conditioned area. All necessary contactors, over load relays, anti-recycle timer relays etc.

shall be housed within this pane. The system shall have digital display of the return air temperature and the set point temperature.

The following safety features shall be provided and the same shall have LED indications:

- Under voltage / over voltage trip.
- Phase Failure / Phase reversal trip.
- High Pressure trip /Low pressure trip
- Compressor O/L & U/L trip
- Antifreeze thermostat trip
- Compressor high temperature trip

The microcomputer controller should offer the following user-friendly features:

- Run time equalization: To calculate and ensures equal run time for all compressors.
- Auto restart after power failure: to avoid inconvenience of manual restart.
- Memory back up: To keep settings intact during power failures and stoppages.
- Built-in-time delay: To protect compressor from instant stops and starts.
- Single phasing and reverse phase protection: To protect compressors from damage.
- Fuzzy logic: To cool intelligently based on the heat load, and hence to increase efficiency.
- Self-fault diagnostics: To display system trips to facilitate faster corrective actions.
- Easy hook-up with fire alarm system: Potential free contacts to be provided for hooking on to the fire alarm system, for stopping the units in the event of a fire.
- Sequencing of operations shall be programmed for starting/stopping various drives.

#### **CONTROLS:**

All controls shall be electric and complete with auxiliary relays, contractors, wiring, etc. AHU unit controls shall be as follows:

- Control circuit energized when fan is started.
- Dry bulb temperature shall be controlled by means of a supply air thermostat to switch off the compressor.
  - All the compressors connected to respective AHU's shall operate and should be under supervisory control of another microprocessor to distribute the run time for each compressor equally.
- Extra contractors shall be provided in the control circuit to automatically shut off the AHU on receipt of a signal from the fire alarm system and for remote control operation.

A wired remote controller with sufficient wire length shall be placed inside the inspection room. The remote controller shall display return air temperatures, humidity, set temperature, HP/LP trip, Compressor O/L & U/L trip, AFT(Anti-freeze thermostat) signal reading, etc. If the remote could not display all the above indications, a separate instrument shall be provided and placed along with the remote controller. **The necessary sensors required for the system are considered in the scope of supply by the bidder/ contractor.**

#### **TESTING:**

The capacity of the units shall be acceptance tested in accordance with the latest IS standards. The bidder shall run the plant for 12 hrs and every hour reading to be taken and

the same has to be computed and submitted with performance test reports. Performance guarantee tests shall be conducted at site after completing the installation in all respects to establish cooling, powerconsumption, vibration and noise. In case the guaranteed performance could not be achieved, thesame shall be repeated after necessary repairs/modifications.

### 9.3 **REFRIGERANT PIPING:**

**Scope: Scope of this section comprises of the supply, installation, testing and commissioning of Refrigerant piping for the Air-cooled Air-conditioning system.**

#### **GENERAL CONDITIONS:**

The scope of this section covers supply, laying, testing and commissioning of copper refrigerant piping. The Vendor shall prepare his working drawings for approval by the NFC Officials before execution at site.

The vendor shall design the piping and prepare installation drawings showing full details of piping arrangement, pipe sizes and thickness, methods of supporting pipes and connections in various components for approval of NFC Officials. Work shall commence only after approval. Piping shall be able to withstand the thermal stresses and vibrations encountered during normal operations.

Refrigerant pipe sizes indicated in the tender is only tentative and the Vendor shall confirm the same. Refrigerant piping shall be designed as per the requirement of the system. Suction risers shall be designed as per the minimum load requirement of the system. The Vendor shall submit the design calculations for the same for the NFC Officials approval and then execute the same at site.

#### **CONSTRUCTION:**

Hard drawn copper pipes shall be used for the refrigerant piping. The copper pipe thickness shall be as per ASTM B88 K-type. Fittings like bends, tees, and sockets shall be of copper or brass and shall be suitable for duty involved. Flare type compression fittings shall be allowed upto 15mm size for which annealed copper tubing is used. Tubes upto and including 15mm size may be bent to form 90deg. bends with inside radius not less than 3 tube diameters. For bigger sizes, bend fittings as mentioned above shall be used. Valves shall be of packed, back seating type, and shall be forged or cast brass construction. Joints between pipes or pipes and fittings shall be of the socketed or flanged type. Brazing alloy of the silver-copper-Phosphorous type shall be used and joints shall be made by the flow of brazing alloy by capillary action along the annular space between the two mating surfaces. Ends of mating tubes shall be square cut and cleaned properly to remove burrs and dirt or oxide. For flare type fittings, tubes shall be fully annealed at the flare before and after flaring.

#### **HOT GAS LINE:**

- Oil entrainment by hot gas shall be achieved under all load conditions likely to be encountered during normal operation.
- Horizontal lines shall have a grading of at least 1:250 away from the compressor and towards condenser to permit gravity draining of oil to condenser.

- Equalizer lines shall be provided if called for in tender schedule. These shall be horizontal and have the same size as the discharge line of the largest compressor for hot gas and oil equalizers.
- Hot gas mufflers shall be installed in vertical position or in horizontal position graded away from the compressors. Mufflers shall be designed to prevent oil trapping.

#### **LIQUID LINE:**

- Liquid lines shall be sized to ensure that flashing of liquid refrigerant does not occur.
- Liquid line solenoid valves shall be provided with test switches to enable manual energizing.
- A full flow brass liquid strainer with bronze screens and permanent magnet shall be provided in a readily accessible position with isolating valves and by pass line along with valve. Screens shall be easily removable.
- Each liquid line shall be provided with a permanently installed refrigerant drier or rechargeable type. Drier shall be installed in valve by pass line.
- Liquid cum moisture indicator shall be installed on all liquid lines.
- Wherever liquid receiver is provided, it shall be fabricated from electric welded steel and have a total capacity to hold not less than 1.25 times the volume, in liquid state, of the refrigerant in the system. Liquid level indicator shall be provided with the receiver.
- Suction trap of adequate capacity shall be provided before each compressor or grouped compressors connected in parallel to collect all oil and refrigerant slugs.

#### **SUCTION LINE:**

- Oil shall be entrained by the suction gas under all conditions of load likely to be encountered in normal operation.
- Horizontal suction lines having suction trap or suction line at separator shall be pitched at least 1:250 in the direction of flow of refrigerant.
- Piping should be so designed as to ensure that oil would not separate from gas and drain to compressor in slugs.
- Piping shall have loops and direction changes to absorb normally encountered vibrations.
- All suction line shall be insulated as specified in Section "Insulation". Insulation shall be carried out only after pressure testing is completed.

#### **ISOLATING VALVES:**

If required isolating valves shall be provided to isolate each compressor, liquid receivers if provided, evaporators, strainers, drier and any other component requiring proper operation and maintenance.

#### **PIPING INSTALLATION:**

The entire refrigerant piping shall be installed in a workmanship like manner, true to alignment and grade as required. Tube ends shall be kept plugged or kept closed at all times before installation and where practical, during construction, to prevent ingress of moisture and foreign matter. All dust and welding flux should be removed before installation. Piping supports shall be spaced not more than 2 meters apart and substantial enough to prevent bending stresses. The supports, shall be rigid type, either ceiling hung/wall bracketed angle iron. Each support shall be isolated from pipe by providing anti-vibration springs or neoprene



rubber liner. Valves shall be supported separately to avoid transmission of stresses to connected pipes. The piping shall be carried with soldered/ brazed socket fittings. All the refrigerant piping shall be insulated with 19 mm thick closed cell elastomeric /XLPE insulation and covered with suitable thick/mill glass cloth and finished with polysield coating with at least two coats of resin and hardener or single compound Lag Coating AF 5590.

#### **PRESSURE TEST:**

After completion of piping installation, entire piping installation shall be pressure tested with dry Nitrogen at the following pressures. The high pressure shall be not less than 40 bar and low side pressure not less than 20 bar. Testing shall be carried out as follows.

- Systems shall be charged with inert gas (Nitrogen) to 1kg/cm<sup>2</sup> gauge pressure and all joints shall be checked for large leakages with soap solution. Leaks shall be marked, pressure released and repairs carried out. Brazed joints that leak shall be opened and redone. These shall not be required by addition of brazing alloy to the joint.
- System shall be charged with Nitrogen to the pressure specified as above. Leak detection and repairs to leaks shall be carried out till no leak exists.
- After all leaks have been repaired; system shall be retested with test pressure maintained for not less than 8 hours. No measurable drop in pressure should be detected after pressure readings are adjusted for temperature changes. Pressure gauges and controls may be closed during pressure testing.

#### **EVACUATION:**

- After pressure testing is completed, evacuation shall be carried out as follows after releasing pressure.
- A 2 stage rotary vane vacuum pump shall be connected to the refrigeration system. On no account should the compressor be used for purpose of creating vacuum.
- Vacuum pump shall be operated to reduce the pressure to 250 microns absolute and allowed to hold for 6 hours.
- Vacuum shall be broken with a mixture of dry Nitrogen and a small quantity of refrigerant to be used. System shall be evacuated to 100 microns and allowed to stand for 24hrs. Leak detection with halide torch or electronic leak detector shall be carried out.
- If no leak exists correct quantity refrigerant and oil shall be charged into the system. Final leak detection should be carried out once again to ensure leak tightness.
- If ok proceed for refrigerant charging.

#### **CHARGING:**

- Charge refrigerant in liquid form, through liquid line port.
- Use weighing machine to charge exact calculated amount.
- Weight the refrigerant cylinder before and after charging.
- After complete charging open both suction and liquid ball valve of outdoor unit.
- If full additional charge cannot be charge in liquid form, then charge balance amount in liquid form by using the suction service valve with system working in cooling mode.
- After charging refrigerant remove manifold and refrigerant cylinder and replace caps of service valves.
- Close (Front End) both suction and liquid service valves
- Check for leaks in service valve connections.

**PRE-COMMISSIONING CHECK LIST:**

- All required commissioning tools are available
- Correct amount of refrigerant is calculated as per installed liquid line
- Correct amount of refrigerant and weighing machine is available at site
- Pressure testing done as per standard
- Evacuation done as per standard
- Refrigerant charging done as per standard
- Communication wire connected to outdoor PCB
- Continuity of communication wire checked
- Permanent power supply of allowed range is available in all Indoor Units and ODU.
- Correct size of MCB and cables are installed
- Dip switch setting of IDU and ODU done
- All filters and coils of Indoor Units are clean
- Proceed for commissioning if all above steps are ready

**COMMISSIONING:**

- After refrigerant charging, energise the power supply to outdoor unit so that crankcase heater is energised for minimum 4 hours.
- Set dip switch settings.
- Check continuity of communication wiring.
- Check all electrical connections are tight.
- Check incoming voltage at power terminals.
- Operate the indoor units by unit controller or group controller.
- Observe for any abnormal noise.
- Observe parameters and inside conditions for 12 hours.
- Handover the system to customer along with user manual.

9.4 **INSULATION WORK:**

***Scope of this section comprises of the supply and fixing of insulation work confirming to the specifications and in accordance with the requirement and of the Schedule of Quantities.***

**GENERAL CONDITIONS:**

The Vendor shall ensure that samples of all forms of insulation material to be installed are submitted to NFC Officials for their approval within 30 days from the date of issue of letter of intent. NFC shall have the right to reject all subsequent supplies that do not conform to the approved samples.

All insulating materials in the form, which it is used and under the condition anticipated, shall not ignite, burn, support combustion or release toxic gases when subject to fire or heat. All adhesives used to stick insulation shall also be non-flammable.

Manufactures recommendation for application & safety shall be strictly adhered to.

**THERMAL INSULATION FOR DUCT:**

Ducts shall be thermally insulated with specified thick flexible thermal insulation made out of Cross Linked closed cell polyolefin/ polyethylene foam, factory fused to a reinforced 9

micronaluminium foil and longitudinal and transverse joints sealed with self-adhesive tape of same material.

#### **MATERIAL SPECIFICATIONS**

- Cross linked, closed cell polyolefin foam with factory applied, reinforced aluminium foil.
- Optional factory applied acrylic adhesive backing
- Density : 30 kg/m<sup>3</sup>
- Thermal conductivity: Maximum 0.032W/m.k @ 23°C.
- Moisture absorption : < 2%
- Resistant to growth of fungi and vermin
- Service temperature : - 40 °C to 115°C
- The material should confirm to class 0, self-extinguishing, does not drip due to reaction with fire, dust, CFC, HCFC and fibre free with zero ODB.

#### **FIRE RATING:**

- Minimum fire rating as per EN 13501-1 shall be B-s3,d0

#### **INSTALLATION PRE-CHECKS:**

- All joint should be butted firmly against each other, seal all joint with 75mm reinforced aluminium foiltape; no gluing in joints is required.
- Insulate each duct separately. Flanges should be insulated with a 120mm wide strip of insulation material.
- No additional vapour barrier or coatings are required.
- All supporting hangers should be lined with the same insulation material to avoid excess compression of insulation .(refer manufacturers instruction)
- Ensure no air pocket during the installation of the insulation to the duct.
- Any minor surface cuts should be covered with aluminium foil type

#### **INSTALLATION METHOD:**

- All duct work should be clean of grease & oil. To clean the duct first wipe down with a clean cloth to remove excess duct to remove grease & oil a suitable solvent should be used such as methyl based spirit or acetone. Wipe ducts clean and allow solvent to evaporate.
- Work in a reasonably clean area and avoid dusty places.
- The recommended wet glue system is rubber/ neoprene based contact adhesive.
- Ensure both surface ( GI sheet and insulation are free on dust and grease)
- The surface should be wiped with a clean cloth.
- Apply glue to the both the GI surface and the insulation.
- Wait until the surface is tack – dry(2-5 minute) and the solvent evaporated.
- Bring the surface together and apply pressure.
- Firstly cut the required length of insulation material required
- Cut the insulation material to the required length. Always allow excess 20mm for final adjustment donot peel the backing paper off at this stage.
- Lay duct section on the floor. To avoid damage to the insulation, use cardboard sheet on the floor.

- Peel off only a small section to start off with (150mm). Align with duct edge with the insulation sheet edge and gently lower to the duct.
- Pad firmly starting from the fixed edge move to the other edge by lowering the insulation to the duct progressively whilst padding insulation at the same time. Peel off enough paper to cover one side at the time only.
- Ensure air is expelled.
- DO NOT TRY TO LOWER ENTIRE SHEET TO ONE SIDE OF THE DUCT AT ONCE. THIS WILL LEAD TO TRAPPED AIR POCKETS.
- Once one side is fixed turn to duct expose new bare side.
- Slowly peel off enough backing paper to cover the edge and side of duct. Slowly pad the adhesive to the edge; DO NOT PULL THE INSULATION ON THE DUCT CORNER. Guide the insulation over the corner the pressing lightly. The insulation on the corner should be the same thickness as on the flat sections.
- Repeat until completely covered on the final side ensure the insulation length reaches the same level as the starting edge Trim off excess length with sharp knife until it is level with adjacent side.
- Use aluminium foil tape to seal the joint
- Provide nylon strapping at 600 mm spacing each to prevent sag. Strapping to be applied to widths of all ducts. Ensure strapping do not tear the aluminium foil.

#### **ACOUSTIC INSULATION OF DUCTS:**

Material of construction shall be 20 mm thick open cell elastomeric nitrile rubber foam of density 140 – 180 kg/m<sup>3</sup> and of fire rating CS3d0 – EN13501. Thermal conductivity of the material shall not exceed 0.050 W/m.K. The insulation material shall be stuck to the cleaned duct surface by cold adhesive. The service temperature the material shall be -40 °C to 85 °C.

The methodology as indicated above for duct thermal insulation shall generally be adopted for acoustic insulation also.

#### **9.5 GI DUCTING**

***Scope of this section covers the general design, materials, construction features, manufacture, shop inspection and testing at manufacturer's works, delivery at site, handling at site, installation, testing, commissioning and carrying out performance test at site of Air Distribution Duct System.***

#### **CODES AND STANDARDS**

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

IS 277 Galvanized Steel Sheets (Plain and Corrugated)

IS 655            Metal Air Ducts  
 ASHRAE        Duct design method  
 ASHRAE 70    Method of Testing for Rating the Performance of Air Outlets and Inlets

**MATERIAL REQUIREMENT**

Ducting shall be fabricated from Galvanized Iron sheet. GI sheet shall be of lock-forming grade and zinc coating as per IS 277. The coating grade shall be minimum 200 GSM.

**CONSTRUCTION FEATURES**

Fabrication details shall be generally in accordance with the details given hereunder.

<u>RECTANGULAR DUCT (G.I.) ( SUPPLY DUCT)</u>			
For Low Pressure System (up to static pressure of $\pm 75$ mm WC)			
LARGER SIDE OF DUCT	THICKNESS OF SHEET mm/G	TYPE OF TRANSVERSE JOINT	TYPE OF REINFORCEMENT
mm	SWG		
Up to 250	24 G	25×25×3mm CS angle flanged joint	----
251 to 750	24 G	25×25×3mm CS angle flanged joint	25×25×3 mm CS angle @ 1,250 mm c/c
751 to 1000	20 G	25×25×3mm CS angle flanged joint	40×40×3 mm CS angle @ 1,250 mm c/c
1001 to 1500	20 G	40×40×3mm CS angle flanged joint	40×40×6 mm CS angle @ 750 to 800 mm c/c
1501 to 2100	20 G	40×40×6mm CS angle flanged joint	50×50×6 mm CS angle @ 750 to 800 mm c/c
2101 to 2400	20 G	65×65×6mm CS angle flanged joint	65×65×6 mm CS angle @ 750 to 800 mm c/c
2401 and above	20 G	50×50×3mm CS angle flanged joint with tie rods of 10 mm diameter	50×50×3 mm CS angle @ 750 to 800 mm c/c with tie rods of 10 mm diameter, evenly spaced along reinforcing angle, spacing not exceeding 1,500 mm

Longitudinal seams shall be Pittsburgh lock type at corners. Longitudinal joints shall not be provided for rectangular ducting at locations other than corners, except where larger side of duct exceeds 2500 mm. longitudinal joints of ducting having side larger than 2500 mm other than corner shall be grooved or of standing seam.

Flanges used for transverse joints shall be joined with each other with Galvanized Steel (GS) bolts, washers and nuts. The bolts shall be of minimum M8 size and the spacing between bolts shall be maximum 150 mm for low-pressure system and 100 mm for high-pressure system.

For transverse angle flanged joints, neoprene/ EPDM gasket (3 mm uncompressed thickness and width equal to flange face) adhered to the flange face shall be used. The bolt holes in gasket shall be the same as bolt diameter and shall be punched prior to insertion of gaskets.

Angles shall have welded corners and shall be riveted to the ducts at 300 mm centers (maximum).

Ducts shall be factory fabricated using lock-forming machine.

**DUCT SUPPORTS**

Rectangular duct shall be supported from ceiling using trapeze hangers. Ducts shall rest on supporting angle or channel and this supporting angle or channel shall be supported by CS rods or angles or channels on both sides of ducts with weld or bolts.

Supporting details for low pressure system shall be as given below:			
LARGER SIDE OF DUCT mm	SUPPORTING ANGLE mm	VERTICAL ROD DIAMETER mm	MAXIMUM SPACING BETWEEN SUPPORTS mm
Up to 900	40×40×6	10	3,000
901 to 1,500	50×50×6	10	3,000
1,501 to 2,400	50×50×6	10	2,000
2,401 and above	65×65×6	12	1,600

Zinc coated anchor fasteners or embedded plates shall be provided for upper attachments to the building. The CONTRACTOR shall provide anchor fasteners & embedded plates. The CONTRACTOR shall provide duct supports from angle cleats welded to the embedded plates. Anchor fasteners shall be loaded to maximum 20% of the maximum rated capacity specified by the manufacturer. The PURCHASER shall approve all anchor fasteners used for supporting duct.

In case of insulated duct, anchor fasteners shall be selected based on actual total load. Duct supports shall be qualified and sized for seismic forces.

Ducting shall be made in circular or square shape as per the site requirement. For providing duct supports, above table given for rectangular ducts shall be considered by taking diameter of circular duct as longer side of rectangular duct. 6mm thickness CS round flange shall be welded to circular ducts at a span of 6 meters maximum or as per site condition.

9.6 **GRILLS/ DIFFUSERS:**

The grilles and diffusers shall be made Aluminium of thickness 0.8 mm and shall be powder coated along with all necessary hardware.

9.7 **VOLUME CONTROL DAMPERS:**

Square/ rectangular Factory fabricated low leakage volume control/duct dampers shall be with chrome plated spindles, self-lubricated bushes, full enclosure for blade linkages, operating handle equipped with position indicator. 18G GI for frame,20G for Blades. Frame with flat frontal face to suit flanged connections with the ducts. Frames to be screw fixed and sealed to eliminate casing leaks. Blades to be pivoted on PVC bushes and operated through PVC gear system to be fully enclosed within the damper frame.

9.8 **MS Supporting structure:**

Ducting supports shall be designed to carry weight of ducts. The drawing shall be submitted for approval for its load carrying capacity. For the duct supports trusses shall have to be provided. It may please be noted that the duct support for road crossing shall be erected at height of 6 meters. Necessary safety appliances and safety permit shall be taken by the contractor. The painting shall be done as per the clause under painting. The structure shall be made of structural steel conforming to IS: 2062. The work should be carried out as per good manufacturing and installation practices in concurrence with approved drawing. All welding electrodes to confirm to relevant IS codes. Fabrication and erection of the structural steel works shall be as per IS : 800 and welding work as per IS:816 and IS : 822. Finally all steel work to be painted with one coat of zinc chromate primer and two coats of synthetic enamel paint.

9.9 **Flexible Connections:**

Where sheet metal duct connects to the intake or discharge of fan units, a flexible connection offire retarding double layer heavy duty canvas material of at least 150 mm width shall be provided. The material shall be attached to angle frames by means of a steel band over the end of the flexible connection. The material shall be secured between the band and the angle frame by bolting. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for fan intake and outlet pressures.

9.10 **MEASUREMENTS:**

**DUCTING:**

Measurement for ducting shall be carried out on the basis of centre-line measurements as described in following paras.

Duct work shall be measured on basis of external surface area of ducts. Duct measurement shall be taken before the application of insulation if any. The external surface area of duct shall be calculated by measuring the perimeter comprising of width and depth, in the centre of each duct section and multiplying it with overall length from flange face to flange face of each duct section and adding up areas of all duct sections.

Surface area of the supply air plenums for linear and slot diffusers shall be added to the duct quantities.

For tapered rectangular ducts, the average width and depth shall be used to measure perimeter, whereas for tapered circular ducts, the diameter of section midway between large and small diameters shall be adopted. The length of tapered duct section shall be the centre-line distance between the flanges of the duct section.

For special pieces like transformations, bends, offsets and branch connections, mode of measurement shall be identical to that described above using the length along the centre-line. End cover or closure shall be measured as per end duct cross-section area (width X height).

The quoted unit prices for ducts shall include all wastage allowances, reinforcement angles or flats, duct supports, flanges and gaskets for joints, nuts and bolts, anchor fasteners, angles, channels, flexible connections at equipment inlet and outlet, splitter dampers, access doors, turning vanes and straightening vanes. These accessories shall neither be separately measured nor paid for.

**DIFFUSERS:**

Areas shall be calculated by measuring cross-section area for air flow at discharge or capture area excluding flanges. In case of supply air diffusers, VCDs shall form part of unit prices quoted and shall not be separately measured or accounted. Frame work for diffusers shall also be included in unit prices quoted.

**LINEAR DIFFUSERS:**

Linear diffusers shall be measured by linear measurements only for each size or width, and not by cross-section area. Linear measurement shall exclude mounting flanges. Frame work for linear diffusers shall also be included in unit prices quoted and shall not be measured separately. The supply air plenum for linear diffusers shall be measured identical to ducting as described earlier.

**SLOT DIFFUSERS**

Slot diffusers shall be measured by linear measurements only and not by cross-section area. Linear measurement shall exclude mounting flanges. Frame work for slot diffusers shall also be included in unit prices quoted and shall not be measured separately. The supply air plenum for slot diffusers shall be measured identical to ducting as described earlier.

**GRILLES**

Area shall be calculated by measuring width and height, excluding flanges. In case of supply air grilles, VCDs shall form part of unit prices quoted and shall not be separately accounted. Frame work for grilles shall not be estimated separately and shall also be included in unit prices quoted.

Painting shall not be separately measured or paid for. Various quoted unit prices shall include painting wherever specified or required.

**DUCT THERMAL INSULATION:**

The duct areas to be insulated should be measured and recorded before application of insulation. Then, the thickness of insulation shall be added twice to the depth and width and the insulation area shall be calculated and paid for.

The rate per sq.m of insulation shall be inclusive of basic insulation material, all finishes as specified.



**DUCT ACCAUSTIC INSULATION:**

The duct areas to be insulated should be measured and recorded before application of insulation. Then, the thickness of insulation shall be REDUCED twice to the depth and width and the insulation area shall be calculated and paid for.

The rate per sq.m of insulation shall be inclusive of basic insulation material, all finishes as specified.

**10.0 TESTING/ ADJUSTING/BALANCING:**

**Scope: Scope of this section comprises of the Testing, Adjusting and Balancing.**

**GENERAL CONDITIONS:**

After completion, all duct systems shall be tested for air leakage. The entire air distribution system shall be balanced to supply the air quantities as required in the various regions and rooms to maintain the specified room conditions. The air quantity shall be measured and if need be the motor pulley need to be changed to site requirement when balancing the system. The entire air distribution system shall be balanced to supply the air quantities as required in the various regions and rooms to maintain the specified room conditions.

The leakage through the ducting system shall not exceed more than 6% of the total air quantity as per DW/144 standards.

The vendor should carry out the duct leak testing at site in few ducts as required by the NFC officials if they notice the poor quality of workmanship or if the test reading is not found satisfactory.

The final balance of air quantities and its temperatures through each grille, register or diffuser shall be tested and recorded and submitted to the project manager for approval.

**LEAK TESTING PROCEDURE:**

- Once the leakage-testing rig is in place, the following test procedure may be adopted:
- Connect test apparatus to section of ductwork to be tested.
- Adjust test apparatus until the static pressure differential is obtained.
- Check that the measured leakage is within the permitted rate. (No addition shall be made to the permissible leakage rate for access panels or dampers where these are included in the ductwork).
- Maintain the test for fifteen minutes and check that the leakage rate has not increased.
- Reduce pressure in section to zero by switching off the fan; then immediately re-apply test pressure to establish that the air leakage rate is not greater than the previous reading.

**AIR BALANCING:**

On completion of the work, the system shall be demonstrated to the satisfaction of the Engineer and air flow at each fan outlet and all air distribution outlets is correctly adjusted and regulated, to fulfill its specified functions and as per designed airflow rate.

The work shall be carried out in accordance with the approved commissioning schedule and shall cover, but not necessarily be limited to, the following activities.

The entire air distribution system shall be balanced with the help of an anemometer. The measured air quantities at fan discharge and at the various outlets shall be within +/- 5 percent of those specified / quoted. Branch duct adjustments shall be permanently marked after the air balancing is completed so that these can be restored to their correct position if disturbed at any time.

Air circuit clean-up shall be carried out and all internal debris and foreign matter removed prior to the commencement of commissioning.

The functioning of the total system and all ancillary units shall be demonstrated and shown to be operating consistently within the prescribed limits.

All instruments, controls and safety equipment shall be correctly calibrated under the supervision of a qualified, specialist engineer.

Calibration data shall be submitted together with test certification.

All warning and safety controls shall be proven by producing the actual circuit conditions(s) required for actuation whenever practicable. Injected signals or other synthetic means of simulating unsafe or other synthetic means of simulating unsafe conditions may be utilized with the approval of the Engineer.

Noise and vibration levels shall be measured and if it exceeds the accepted limits then corrections have to be undertaken to the satisfaction of NFC Officials.

- Measure the flow at each outlet of the terminal branches
- Find out the index terminal and keep the damper fully open
- Balance the other outlets proportionally to the same percentage of flow set in the branch duct.
- Check the flow in each outlet and record including the index terminal.
- Take the total flow in the main duct again and record by using traverse duct method.
- After Total System balance, the following values shall be measured and recorded.
  1. FanRPM
  2. Motor voltage and amperes
  3. Static pressure entering the Fan
  4. Static pressure leaving the fan
- Static pressure entering and leaving the fan shall be measured as follows:
  - Static pressure readings leaving the fan shall be taken as far as from the fan as is practical, but shall be before any restrictions in the duct (such as duct turns).
  - No readings shall be taken directly at the fan outlet or through the flexible connection.
  - Static pressure entering the fan shall be measured in the inlet duct upstream of any flexible connection and downstream of any duct restriction.
  - Static pressure entering a double inlet fan shall be measured through the wall of the plenum, which houses the fan.

- In all cases, the reading shall be taken to represent as true a value as possible. True value is actual measured static pressure.

#### **BALANCING AIR TERMINALS PROCEDURE:**

- Depending upon location and access to air terminals, various types of airflow measuring instruments will be utilized to record the actual airflow at terminals.
- Assuming adequate access provided, a direct reading balometer would be used which gives a direct reading of volume rather than velocity, which cancels out the need for effective grille areas, terminal configuration consideration and velocity corrections.
- If access is restricted then a rotating vane anemometer shall be used and the velocity reading obtained would be converted to volume (velocity x free area = volume) and a comparison between the pitot traverse reading will be made to obtain a correction factor which would be incorporated to give a true velocity reading.
- Alternatively, the effective area provided by the register / grille manufacturer will be incorporated in the design velocity calculations.
- Air quantities shall be measured according to CIBSE Application Guide 3/89 Standards.
- Any main branch may be chosen to start with but as normal practice and having carried out a rough balance of main and sub-branches, start with the most remote branch and then sub-branch.
- Locate the terminal, which is discharging the lowest percentage of its design flow rate. This is generally the last terminal in the run. If not, adjust the damper in the last terminal unit until it is working with the same percentage as the lowest one previously measured.
- Measure the flow from the terminal next to the index and work out the percentage flow as close as possible to that of the index. Fix the damper in position.
- Repeat the procedure for the next terminal, again comparing it with the index.
- As the dampers are closed along the run, more air will be driven towards the downstream terminals and the volume of air discharged at the terminal index will rise. This does not affect the balancing procedure since each terminal being adjusted is related in turn with the index.
- When all the terminals have been balanced on a sub-branch, each terminal will be running with an equal percentage of the design flow rate, within the allowable tolerances.
- The flow rates at each terminal must be measured and recorded. Once again a summation should be made to check that the total is in reasonable agreement with the measured sub-branch flow.
- Test results shall be recorded in the approved test sheets and documents.

#### **MECHANICAL AND ELECTRICAL 72-HOUR SYSTEMS ACCEPTANCE TEST:**

- The purpose of the 72-hour systems test is to demonstrate that the overall system will function reliably and in accordance with the design documents.
- Systems that are capable of producing trend logs for control points shall be utilized to produce these logs to record the status of temperature, pressure, humidity, etc., during the test. The points to be monitored will be determined by Vendor and Client.

- The 72-hour test is a prerequisite to obtaining a notice of Substantial Completion for the mechanical, electrical, and control systems. Equipment and systems warranties shall begin with Substantial Completion and acceptance by Client.
- Successful completion of the 72-hour test is a prerequisite to obtaining a notice of Substantial Completion for the mechanical, electrical, and control systems. Equipment and systems warranties shall begin with Substantial Completion and acceptance by Client.
- All HVAC systems and associated control and alarm interlocks shall be operated for a period of 72 consecutive hours. During the 72-hour period, all systems shall function in a completely automatic mode without any equipment shutdown or malfunction. All systems shall operate to maintain design sequences and conditions.
- Any system shutdown, malfunction, or deviation from design sequences during the 72-hour test will be cause to discontinue the test and restart after faults are corrected. Client will determine if a failure is severe enough to discontinue the test.

**PROFORMA FOR TEST RESULTS & NOTES ON TEST INSTRUMENTS AND CAPACITY COMPUTATIONS:**

S.No	Item	Test Results
1	Ambient conditions: D.B.Temp ----- deg C, W.B.Temp ----- deg C, % RH-----	
2	Compressors: R.P.M-----, Suction pressure ---- kg / sq.cm, Discharge pressure --- kg / sq.cm, Oil pressure ----- kg / sq. cm	
3	Motors: R.P.M-----, Voltage ----- Voltage, Current ---- amps	
4	Fresh air intakes Face area: --- -Sq.m, Air quantity ---- Cu.m/min	
5	Room conditions at the working place. Temperature(No. of readings shall be taken and D.B. -deg Averaged out), W.B.--- - deg C, Noise Level----- dB	
6	Controls Function of each control shall be tested and report furnished	

**NOTES: Test Instruments:**

1. All instruments for testing shall be provided by the air conditioning contract.
2. Thermometers used for measurement of temperature of water/ refrigerant shall have graduation of 0.1 deg C and shall be got calibrated from N.P.L. or any recognized test house before hand.
3. Thermometers used in the psychometry shall have graduations of 0.2 deg C and shall be calibrated as at (2) above.
4. If due to any reason, internal load mentioned in the tender specifications is not available psychometric computations for actual load conditions will be done and the plant, if found satisfactory will be accepted.

**11.0 INSPECTION AND TESTING:**

Inspection and testing of equipment and whole system shall be carried out by the contractor as specified above. No extra cost shall be paid to the contractor. Contractor shall include this cost also in his quoted rates of individual items. All instruments & items required for testing shall be arranged by the contractor.

**12.0 BALANCING:**

The air distribution system shall be tested and balanced as specified above so that the requisite temperature and air flow are maintained throughout the space to be air-

conditioned or ventilated. No extra cost shall be paid to the contractor. Contractor shall include this cost also in his quoted rates of individual items. All instruments & items required for testing shall be arranged by the contractor. Splitter damper and VCD adjustments shall be permanently marked after air balancing is complete so that these can be restored to their correct position if disturbed at any time.

**13.0 STARTER/ MOTOR CONTROL/DISTRIBUTION PANEL SUITABLE FOR AHU/ CONDENSING UNITS:**

415 V, 3 Phase Motor Control Centre made out of 12 SWG CRCA steel with L&T/Siemens/ABB/Schneider components for the following feeders. The MCC shall be fabricated as per latest ISS and IE rules. The ratings of the switches/MCCBs as specified for each feeder below shall be suitable to the rating of the drive (pump/ blower) provided and shall be subjected to the approval of the department with the following components.

- a. \_\_\_ TPN SDFU incomer – 1 No
- b. \_\_\_ HP star delta starter with MCCB for condensers units - 3 Nos
- c. \_\_\_ HP star delta starter with MCCB for blowers - 3 Nos.
- d.---- LED type RYB indication lamps on line side of Incomer with MCB – 1set
- e.---- Trivector meter with Ethernet & RS485 connectivity of secure/Enercon make on the outgoing side of Incomer with MCB protection – 1Set

Main power supply, if not specified otherwise in the BOQ or elsewhere, shall be terminated by the client in this panel and feeder cables to feed power to the all drives shall be carried out by the AC Vendor only.

The MCC panel shall consist of starters, isolators, ELCB, digital energy meter, indicating lamps etc., and shall be selected to suit the rating, capacity, type and size required for the electrical drives / components etc., being used in the complete AC system.

A selector switch enabling the running of the fan alone with cooling shall be provided. Reset facility shall be provided. Interlocking of compressor power supply with air handling fan shall be provided through door interlock. The panel shall allow temperature set point adjustment, Fan fails indication. The following mode selection shall be provided:

- Auto Mode – for auto start in case of power resume.
- Manual Mode.

The MCC panel shall be fabricated from high quality 12 SWG CRCA steel, stiffened and suitably reinforced. The steel sheet box shall be painted with seven tank processes & the final paint coat shall be stove enameled. The overall construction of the panel shall be dust & vermin proof. General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. The panel shall be with front access type. The panel shall have hinged access doors. Overall height of the panel shall not exceed 2.4 meters. Operating levers, handle etc. of highest unit shall not be higher than 1.7 meters. Cable entries for various feeders shall be either from top or bottom. Through cable alleys located in between two circuit sections, either in the rear or in the front of the panel. All cable terminations shall be through gland

plates. There shall be separate gland plate for each cable entry so that there will not be dislocation of already wired circuits when new feeders are added. Cable entry plates shall therefore be sectionalized. Cables shall be terminated using weather proof double compression brass nickel plated cable glands and tinned copper crimped lugs shall be provided. The construction shall include necessary cable supports for clamping the cable in the cable alley or rear cable chamber. The power cable shall be of FRLS PVC insulated, stranded copper wire, 4 core of area suitable to the application or as per OEM recommendation and rated for 1100 V. Name plates to indicate the equipment of circuit controlled by the switches shall be fixed on the panel box.

The bus bars shall be of Aluminium of high conductivity electrolytic quality and of adequate section. All bus bars and connections shall be suitably sleeved / insulated in approved manner. The bus bar system may comprise of a system of main horizontal bus bars and ancillary vertical bus bars run in bus bar alleys on either side of which the circuit could be arranged with front access cable entries. Cable terminations shall invariably be through terminal blocks (Polyamide or superior) or brought out solid terminals. Indicating Lamps On all the incomers of M.V panels, ON/OFF indicating LED lamps shall be provided and shall be suitable for operation on AC supply. Phase indicating LED lamps shall be associated with necessary ON/OFF toggle switch. All small wiring for Controls, Indication etc. shall be with suitable FRLS/HFFR (halogen free fire retardant) copper conductor cables. Wiring shall be suitably protected within switch board. Runs of wires shall be neatly bunched, suitably supported and clamped. The entire panel shall have a common earth bar of size as specified with two terminals for earth connections. Commissioning checks and tests shall include all wiring checks and checking up of connections. Relay adjustment/setting shall be done before commissioning in addition to routine Megger tests.

Only SFU, indication lamps, push buttons and Hooters shall be mounted on the door. All other components shall be housed within the cubicle.

Note: All the motor feeders shall be provided with Local / Remote Selector Switch (two pole), Local ON/OFF push buttons, ON/OFF/ TRIP LED type indication lamps, required contactor with Motor Protection Relay (Make L&T / Siemens/Shneider) offering Over load, single phasing, dry run prevention (under current), phase reversal, phase unbalance protections etc with required wiring up to the terminal block for ON/OFF from push button stations, contacts for dry run prevention from level switch etc.

Wiring shall also be carried out for remote switching from microprocessor with L/R switch in Remote position and for providing potential free contacts for remote indication of ON / OFF, overload trip and L/R switch position at PLC panel.

Wiring shall be carried out with L/R switch in Local position for starting the motor either from MCC or from the local push button station.

The Motor control centre shall be free standing, dead front, sheet steel enclosed type, vermin and dust proof construction suitable for installation in dusty/humid atmosphere. The equipment shall be suitable for use in 415 V  $\pm$  6% 3 phase 4 wire system having a symmetrical short circuit rating of 30 KA. The basic features of design and construction shall be as generally specified below.

The board shall be of modular construction, vertically divided and shall be fabricated with 12 SWG sheet steel all through the panel and 3mm thick for gland plate. For individual feeder sections, bus bar chambers, cable chambers segregated compartments shall be provided with separate doors hinged to the mainframe work. All the doors, top and back covers shall be held securely by using suitable gaskets.

The construction of panel shall be such that it can be readily extended on both sides for additional feeders. For extension of bus bars and other wiring suitable openings shall be provided and removable plates shall cover these openings.

Cable entry to the board shall be generally from the top. However provision shall be made to permit bottom entry of cables. (During drawing approval actual position will be indicated) Separate cable compartments shall be provided for the boards with terminals extended to the cable compartments for easy termination of cables.

Segregated compartment shall be provided for each feeder and shall be fully self contained with circuit elements. The feeder section shall be arranged in tier formation with only operating devices of circuit isolation, ON/OFF indicators, meters etc mounted on the panel door

Suitable shrouds shall be provided in the feeder compartment to cover all the live parts to avoid accidental touch when the compartment door is opened for inspection/maintenance.

Caution boards shall be provided on front and back of the board indicating the working voltage.

All bus bar chambers and cable chambers shall be clearly identified with suitable nameplates embossed on aluminum strips.

All feeders shall be identified by painting after the feeders are connected to the respective loads. Incoming chamber shall be painted outside with red colour as per IE rules.

The maximum operating height of the panel shall not be more than 1800 mm and no feeder shall be provided below 300 mm

The panel shall be painted with one coat of epoxy corrosion proof redoxide paint & 2 coats of Polyurethane paint(Berger/Asian Paints) both inside and out side with approved color shade. Before painting all the metal parts shall be subjected to seven tank pretreatment processes.

The main bus bars shall be electrolytic grade Copper 3 phase and neutral, continuously rated for the specified current and shall be fully insulated with insulated heat shrinkable sleeves.

The bus bars shall be color coded with proper color sleeves or with suitable color bands if black sleeves are used.

The bus bar conductors and epoxy supports shall be suitably selected to with stand the electrical and mechanical stresses due to short circuits.

The bus bar chamber shall have screwed removable cover. The bus bars shall be so arranged that any bus bar can be easily approached for maintenance without dislocating the other bus bar

The bus bar chamber shall be adequately ventilated. The connection between bus bars and terminals of feeder switches shall be properly shrouded so that no live part is exposed.

The spacing between phases and phase to earth of bus bars shall be as per ISS (minimum 25mm for Ph-N and minimum 35mm for Ph-Ph).

All the feeders shall be interlocked type such that the feeder door cannot be opened when the feeder is in ON position.

Make of the components shall be strictly as per specification.

All necessary sensors required for the system shall be included in the scope of supply by the bidder and no specific payment will be done.

The contractor shall submit integrated circuit diagram i.e. MCC circuit diagram, Microprocessor controller and supervisory control microprocessor for approval by NFC.

The work is to be carried out strictly as per the latest ISS and all safety precautions as stipulated by the Safety Engineering Division of NFC shall be followed.

#### **14.1 CABLING WORK:**

Cabling shall be done in accordance with IS 1255. The work shall be carried out in accordance with specification of Indian Electricity Rules as amended up to date and local Municipal Bye-Laws. The power wiring system shall be suitable for 415V, 3 phase, 50 cycles, 4 wire supply. Special care shall be taken to ensure that cables are not damaged at bends. The radius of bends shall not be less than minimum specified by the manufacturer to ensure that no undue stress is caused to cable. Where cables pass through pipes, PVC/Neoprene rubber bushes shall be provided at the ends. Where cables pass through floors or walls, pipe inserts shall be provided and opening shall be sealed. Cables shall be terminated using weather proof double compression brass nickel plated cable glands and tinned copper crimped lugs shall be provided. Conduits, where used, shall be of heavy gauge PVC. Metal saddles of approved type shall be used for fixing conduits on surface. Bends and elbows shall be of inspection type where required. All joints shall be water tight. Conduits shall be secured to the switches, junction boxes etc., by threaded Couplers. Flexible PVC conduits shall be used for connections with vibrating equipment. Suitable means to isolate each motor in case of emergency shall be provided as per IS:900.

The cabling work is for;

- a) Power cabling from MCC to AHU motor, heater, condenser (ODU). As per OEM recommended size and 3 core FRLS PVC sheathed, PVC insulated, GI wire armoured, 1100V grade, stranded Copper conductor cable as per the IS: 1554 (Part-1).
- b) Control cabling from MCC to control microprocessor unit (IDU), IDU to condenser(ODU), and MCC to door interlock and light. 3 core FRLS PVC sheathed, PVC insulated, GI wire armoured, 1100V grade, stranded Copper conductor UG, FRLS cable as per the IS: 1554 (Part-1).
- c) Instrumentation cabling for sensors and interlocks required if any, as per IS: 694 FRLS PVC sheathed, PVC insulated, 1.5 sq.mm, 3 core copper cable.

#### **14.0 EARTHING WORK:**

The earthing shall be done with 8 SWG GI wire or 25 X 3 mm GI flat as per site conditions and requirements. The earthing shall be laid in open fashion with necessary clamps, screws and



interlinks etc. The main panel shall be connected to the main earthing stations by means of G.I. Strips as per Indian electricity rules and IS: 3043 – 1987. All electrical equipment shall be provided with two separate earth connections. The current carrying capacity of earth conductors shall be as per IS: 3043-1987. All earthing connections shall be visible for periodical checking.

**15.0 CABLE TRAY:**

The perforated ladder type cable tray shall be fabricated from 2.0 mm steel and shall be dip galvanized. The tray shall incorporate required vertical bends, horizontal bends and inside bends. The width shall be selected to suit the requirement of the cables being supported.

**16.0 DATA TO BE FURNISHED BY THE CONTRACTOR AFTER THE AWARD OF CONTRACT**

- a) List of drawings and documents to be submitted for review, approval and information with scheduled submission dates.
- b) Quality Assurance Plan (QAP)
- c) Dimensioned general arrangement drawing showing all diffusers, grilles, dampers, plenums, hoods, access doors, flexible connections and all other accessories. Duct supports and transverse joint locations shall be marked on the drawing.
- d) Fabrication drawings for duct showing duct support and guide vane details.
- e) Cross-sectional drawings of volume control dampers, with part list, materials of construction and installation details.
- f) Complete test reports and air balance report shall be submitted for scrutiny and approval.
- g) Operation and maintenance manuals of individual equipment and as system as whole along with drawings, test certificates etc, shall be submitted after completion of entire job.

**17.0 INFORMATION TO BE FURNISHED WITH THE TENDER:**

The bidder shall submit the relevant literature/leaflets/catalogues in respect of the material etc., offered for enabling the purchaser to assess the offers.

**18.0 SCOPE OF SUPPLY BY SUCCESSFUL BIDDER:**

The successful bidder shall supply all equipment and materials described in this tender with such modifications and additions/deletions etc., as are mutually agreed upon.

**19.0 DRAWINGS& INSTRUCTION MANUALS:**

After getting approval of the drawings by the Department, three sets of the following shall be supplied by the contractor before commencement of the work at site.

- a) Approved drawings.
- b) Certified test-certificates in respect of various materials.

**20.0 PREDESPATCHINSPECTION AND TESTING:**

20.1 Routine and type tests or, any other relevant test(s) in respect of the various items of equipment/materials shall be conducted/performed at the contractors/suppliers' works before effecting dispatch to site. The tests shall be conducted in presence of the departmental representative, if so desired by the

department. The contractor shall, therefore, be required to give prior intimation well in advance to the department of his intention of carrying out such tests. The following parameters shall be tested at manufacturers work for P/T AC units:

- a) Run Rest of Blowers/fans, Nominal cooling capacity
- b) Verification of Test certificates of individual components.

20.2 The following items can be delivered to site directly after submission of test certificate and approval regarding material and performance as per relevant standards and as specified in the Tender document.

- i. Cable
- ii. MCB/DB
- iii. Earthing/cable trays
- iv. Small motors
- v. Dampers
- vi. Gasket
- vii. All SS & MS hardware

#### 21.0 **INSTALLATION, TESTING & COMMISSIONING**

21.1 The successful bidder will be responsible for providing all necessary tools, tackles and instruments required for execution and testing of the plant and equipment.

21.2 Trial-run/performance tests, etc., for the system shall be conducted by the contractor after completion of erection work as specified. In case, the work does not meet the intent of the specification, the same will be made good by the contractor so as to meet the specified duty.

21.3 The various readings shall be taken (and results computed) by the contractor during the performance tests of the system.

21.4 On completion of the work, the contractor shall furnish the following immediately.

- i) Five (5) sets of "As executed drawings" along with tracing in ink.
- ii) Five (5) sets of test-result sheet.
- iii) Operation and maintenance manuals

#### 22.0 **GUARANTEE**

The entire installation shall be guaranteed by the contractor for a period of twelve (12) months from the date of completion & handing over in all respects against any defect in design, manufacture/workmanship.

#### 23.0 **PAINTING:**

As mentioned earlier, all exposed metallic surfaces are to be treated/protected with appropriate anti-corrosion treatment. Wherever 2 coats epoxy paint is called, it always means 2 coats of epoxy finish paint only. At all places, 2 coats epoxy finish paint shall be

coated over 2 coats of epoxy red oxide zinc-chromate primer, using appropriate thinner (including surface preparation & cleaning). Epoxy paint shall be of standard make with the consent/approval of the department.

24.0 **APPROVED LIST OF MAKES** of various equipments & components and materials: (Contractor has to supply only the following makes if they conform to the specifications).

Description of Item	Approved Makes
Centrifugal Fan For AHU	Nikotra/ Kruger/Flakt/Nadi/Accel/Almonard/CB Doctor/TCF/Hunidin/Chicago fans/Comfri/Greenheck/ Reitz/Wolter
Condensing units	Voltas/Blue star/Hitachi/Daikin/Carrier/Trane/Mitsubishi /York
AHU	Voltas/Blue Star/Hitachi/Diken/Carrier/Zeco/Edgetech/Caryaire/ ETHOS/ Treat Air / VTS Group / Nutech/ FEDDERS LLOYD/Flakt/System air/ETA/ Trane
Electrical Panel Board/ Motor Control Centre (Powder Coated)	Tricolite/Triton/ Vidyut Control/ Advance panel/ Advance Power/ Khokar/ Loha/load controls / Venkateshwara or CPRI approved.
Electric Motor (TEFC)	Siemens/ Crompton/ Kirloskar/ ABB/ Bharat Bijli
Starters/ Switch gear	Siemens/ L&T/ Group Schneider/(MG) France
Miniature Circuit Breaker (MCB)	Siemens/ Legrand/ Hager/(L&T)/ Schneider
Moulded Case Circuit breaker (MCCB)	Siemens / L & T / Schneider/ Legrand
Air Circuit Breaker (ACB)	Siemens / L & T / Schneider/ ABB/
Push Button Starter	Siemens/ L&T/Group Schneider(MG)
Auxiliary Relays	Alstom/ L&T/ Prok Devices
Line Type Fuse	Siemens/ L&T/GE
Timer	Siemens/ L&T/GE
Terminal Block	Elmax
Contactors	L&T/ Telemecanique/ Siemens/ Schneider
Current transformer	Automatic Electric/ Kappa/ L&T/ Gilbert
Voltmeter/ Ammeter (Digital)	Automatic Electric/ Prok devices/ Gilbert/ L&T/ Siemens / Enercon/Conzerv/ Secure/ Socomec
Digital energy meter	L&T/ Conzerv/ Secure/ Socomec
Indicating Lamps (LED Type)/ Push button	BCH/L&T/Telemecanique/Siemens/ Vaishnav/ Emco/ Kaypee
Single Phase Preventor (Current Base)	L&T/ Minlec
Overload Relays with built in	L&T/ Minlec/Siemens/Group Schneider (MG)

Description of Item	Approved Makes
singlephase preventer	France/ Alstom/ L&T/ Prok Devices
Selector Switches/ Toggle Switch	Kaycee/ Salzer/Siemens/ HPL/ BCH
Change over switch	Siemens/ L&T/ HPL/ GE
Protection Relay	Siemens/ Alstom/ L&T/ Prok Devices
FRLS armoured copper control Cables	Polycab/Glostar/ Havells/ CCI/ BatraHenly/ Skytone/ Universal/ Delton/KEI
FRLS PVC Insulated stranded copper conductor armoured Power Cables	Polycab/ Skytone/ Universal/ Delton/ NICCO/RPG Asian/KEI
PVC Insulated stranded Copper Flexible Wires	Finolex/ National Cables – NC/ polycab/ Skytone
PVC Conduit & Accessories (ISI Approved)	BEC/ Precision/ D Plast/ Polypack
GI sheets	Sail / Nippon / National/ Jindal/Lloyds
Grilles/ Diffusers	WATERLOO-RAVISTAR/ CARRYAIRE/ DURATECH/ THERMOTECH/ACROVENTS/ DYNACRAFT/ AIRMASTER/ COSMOS/OPELLA
Fire Dampers	Caryaire/ Ravistar / Airflow/Airmaster/cosmos
Canvas connection	Arma duct/Climatech
Thermometers ( with brass encasing)	Emerald/ Taylor
Thermostatic expansion valve	Danfoss/Emersion/Sporlon
Flow Switch	Anergy/ Rapid cool
Automatic Air Vent	Anergy/ Rapid cool
Auto Air Vent Valve	Rapid Control/ Anergy
Two way Modulating valve for AHU	Honeywell/ Siemens/Danfoss
Room Thermostat/ AHU & FCU thermostat	Honeywell/ Siemens/Danfoss/ Anergy/ Sporlan
Energy Meter ( BTU meter )	Siemens/Danfoss / Anergy
Polyshieldcoating/ LAG coat	Sharon insulindia/ Pedilitefevicol
Expanded Polystyrene (TF Quality)(Pre-moulded pipe section / slab)	Thermolloyd/ Beard Sell/ Styrene Packagings/ DEBS Products/ P R Pakaging/ Coolite/ Indian Pakaging services
Cross Linked Polyethylene / nitrile	Trocellen/Supreme / Paramount/Armacel/K flex
Glass Wool	Owens Corning/ U.P. Twiga
Bearings	SKF/FAG/NTN/NBC
Anchor fastener	Cannon/Hilti/ Fisher

Description of Item	Approved Makes
Vibration Isolator	Resistoflex/ Dunlop
V belt	Dunlop/Fenner/Hilton

**Name of the work: Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad.**

**Tender No: E/527/2017**

**PREAMBLE TO SCHEDULE OF QUANTITIES**

- 1.0 The scope of work involved: Providing centralized Air conditioning system in wing -1 and removing old AC system in control lab” in NFC, Hyderabad. which includes supply, erection, testing and commissioning of air conditioning system.
  
- 2.0 The tenderers shall note that drawings attached to the tender are preliminary only and site visit may be done in the interest of contractor, which is meant to give an idea of the nature of work involved. The tenderers are advised in their own interest to visit the proposed site of work to acquaint themselves with the site and the working conditions. Successful tenderer shall submit clear engineering drawings containing specifications, design details, material MOC, elevation and dimension details etc. for all items and works for approval of Engineer-In-Charge. Work/fabrication shall be started only after getting approval of drawings/specification from Engineer-In-Charge.
  
- 3.0 The tenderers shall carefully go through the clauses in the notice inviting tenders, Tender and contract, General Rules and directions, conditions of contract, clauses of contract, safety code, model rules for Labour Regulations, etc. and special instructions to the tenderers as also specifications and shall include, in their rates, any sum they consider necessary for the fulfillment of the various clauses contained therein. The items of work and unit rates quoted in the schedule of quantities shall be inclusive of everything necessary to complete the said items of work within the contemplation of the contract and the rates may be quoted accordingly. No extra payment beyond the quoted unit rates shall be allowed for incidental or contingent work, labour, materials or plant unless the exclusions are specifically brought out in schedule of quantities.
  
- 4.0 The rates quoted by the tenderer shall also include for the following:
  - 4.1 Necessary care and precaution against damage/theft to equipment/materials, if any.
  - 4.2 Safe custody and storage of materials at site.
  - 4.3 Transportation of all required material to site, transit insurance, unloading and protection of materials including complying with all safety & security requirements for storing the materials if any.
  - 4.4 Accommodation of contractor’s staff.

- 4.5 Protecting of all supplied/ installed equipments in the area of work falling within the scope of the contract.
- 4.6 Providing approaches required for conveying and spreading the excavated materials, disposing of spoils etc., including crossing over the existing drains, nullahs etc., if required.
- 4.7 Providing scaffolding for height jobs.
- 4.8 The payment of minimum wages as notified by the State/Central Government and implementation of all regulations under contract Labour (Regulations and Abolitions) Act 1970 (Central) and Central Rules 1971 and the rules and orders issued there under from time to time as amended up to date. Necessary books of account and other document for the purpose of these conditions as may be necessary and shall allow inspection the same allowed by a duly authorized representative of Government and further such other information/document as the Engineer-in-charge may require.
- 4.9 For enforcement of the building and other construction workers (Regulations Employment & Conditions of Service) Act 1996 and building and other Construction Workers (RE & CS) Central Rules 1998.
- 4.10 All wastages and taxes including seigniorage tax, WCT, VAT, turnover tax, Service tax, ESI, EPF, labour welfare cess etc., as applicable time to time.
- 4.11 Double handling of construction materials and machinery, if any, due to non-availability of space near the site.
- 4.12 Cost of construction power and water required for the work as stipulated elsewhere.
- 5.0 Following all the safety and security rules and regulations as required by the Department including deploying supervisor exclusively for safety.
- (i) While execution of job/any activities, if there is any deficiency in safety/lack of safety or inadequate supervision is found, contractor is liable to penalize as per discretion of Engineer-in-charge. Any accident, if takes place, will attract heavy penalty.
  - (ii) Non deployment of safety supervisor at site will be charged as per rules.
  - (iii) Minimum quantity of PPE proposed to be brought to site for use for implementation at site.
  - (iv) Delay in progress of work/completion of work in the effort of complying of safety whatsoever pertaining to it will not be considered as a genuine reason/cause for extent of time/or any other financial implications.
  - (v) Record of safety compliance to maintained.
  - (vi) Contractor shall follow best engineering practices and shall deploy well experienced rigger at the time of erection of fair handling units, condensing units, ducting etc.

- 6.0 Police verification certificate regarding character and antecedents shall be taken for all labors engaged in the work from the police station where the person resides. Entry passes will be issued only on submission of police verification certificate.
- 7.0 Contractor shall submit medical fitness certificate for all laborers engaged in the work from a recognized/registered M.B.B.S doctor. Prescribed charges for obtaining police verification certificate and medical fitness certificate shall pay by the contractor.
- 8.0 Contractor shall follow and plan the works to meet the policies of NFC in line with ISO 9001, ISO 14001 & 18001.
- 9.0 Contractor shall follow all safety & security rules applicable to NFC time totime. No relaxation will be permitted.
- 10.0 Procurement source and makes for the all required equipment/material materials shall be got approved from the Department well in advance before initiating procurement along with relevant drawings and other records.
- 11.0 Provided that where any provision of the specification is repugnant to or at variance unless a different intension appears, the provision of the schedule of quantities shall be deemed to override the provision of the specifications and shall to the extent of such repugnance or variation prevail.
- 12.0 Agency and methodology for executing the specialized items shall be got approved from the Department before fixing the agency for such items.
- 13.0 The installation/equipment supplied and erected by contractor shall be guaranteed for 12 (Twelve) months from the date of completion and handing over against any manufacturing defects or bad workmanship. Security deposit will be released to the contractor only after successful completion of guarantee period.
- 14.0 The terms of payment will be as per Departmental payment terms and conditions as indicated below.
- A. For supply:
    - (i) 75% of supply value will be paid after completion of delivery and inspection at site.
    - (ii) 15% of supply value will be paid after completion of erection of the material.
    - (iii) 10% of supply value will paid after commissioning of the supplied material.
  - B. For erection:
    - (i) 90% of the erection value will be paid after completion of erection.
    - (ii) 10% of the erection value will be paid after commissioning.

- C. Due to site conditions/constraints as per the decision of Engineer-In-Charge, if any item is not erected, which is supplied after PDI, then, 100% of supply cost of said item will be paid in final bill after successful completion of work.

## **15.0 NFC Policy – Quality, Environment and Occupational Health & Safety Policy**

### **We manufacture and supply:**

Fuel assemblies, core structural components and sub-assemblies for nuclear power reactors.

Stainless steel & special alloy seamless tubes and high purity materials for high tech applications in strategic industries.

### **We are committed to:**

Meet the Quality requirements of customers,

Prevention of pollution

Prevention of injury and ill health and comply with the applicable statutory requirements

**We strive to** continually improve Quality, Environmental and Occupational Health & Safety performance through technological & administrative measures and by enhancing awareness among employees.

**NOTE: Rates quoted shall be inclusive of all taxes applicable time-to-time and firm throughout the contract period. No escalation clause is applicable to this contract.**



Schedule of quantities ( Tender No:E/527/2017 )					
Name of the work: "providing centralized Air conditioning system to Control lab wing-1 in NFCand removing old AC system in Control Lab, Hyderabad".					
Name of Bidder					
SI No	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE Rs	AMOUNT Rs.
				SUPPLY	ERECTION
					Total
1	<b>FLOOR MOUNTED AIR HANDLING UNITS</b> : Supply, Installation, testing and commissioning of Factory assembled Double Skin AHU of 4400 CFM & 11 TR capacity with 100 mm static pressure, with 50 mm thick, 45 kg/cum PUF Insulated detachable panels, extruded thermal break aluminium profiles filled with PUF and Return Air & Fresh Air mixing box with FA RA dampers with manual operation, panel external skin with 0.63 mm pre-plasticised sheet/pre-painted GI sheet, panel internal skin with 0.63 mm galvanised sheet, AMCA tested, DIDW backward curved fan with EFF1 rating motor, drive arrangement with taper lock pulleys for fan and motor, vibration isolators out of heavy duty rubberised mounts, 10 micron prefilters with 3 ply HDPE 50 mm thick filters having an efficiency of 90% , cooling coil section of 6 row coil with copper header and Aluminium fins with drain pan made with 18 guage stainless steel with externally insulated 12 mm thick closed cell poly ethelene, condensate coil trough with SS-304-18G insulated with 9 mm closed cell elastomeric foam, Limit Switch, Inspection sight glass, Emergency Light, Guard for Inspection Door, outlet damper of aerofoil blades & PVC gears, and flexible fire retardant canvass complete with galvanised hardware. Each of the cooling coil will have independent distributors, electronic expansion valve kit, catch all drierwith ball valve for drier removal., independent DX coil circuit to connectivity to each ODU circuit. Include mixing box section as part of AHU. AHU shall be suilable to connect to DX air-cooled condensing units with all required accessories. The fan shall be selected considering low noise application. Also the inside panel skin of the fan section should be finished with 25 m thick open cell elastomeric nitrile rubber foam.	3	No		0

2	<p><b>AIR COOLED CONDENSING UNITS</b> : Supply, Installation, testing and commissioning of DX Air-cooled Condensing Unit of 11 TR nominal capacity, single compressor type, fixed with energy efficient scroll compressor along with grooved copper tube/ aluminium fins air cooled condenser coil with hydrophilic blue fin anti-corrosion coatings, liquid accumulator, low noise aluminium propeller condensor fan with IP 55 motor etc. All suitably assembled neatly in heavy duty GSS sheet metal cabinet and duly powder coated as per specification. The unit to include built-in safety controls like HP/LP switch, power quality protector, in-built thermal/temperature protection . The operating refrigerant should be ecofriendly. Air Cooled Condensing units shall be supplied with all required accessories like suitable Thermostatic expansion valves, Filter driers along with H.S. valve, flare nuts and soft pipe etc</p>	3	Set		0
3	<p><b>GI DUCTING:</b> Supply, Fabrication, Erection and testing of GI ducting of minimum 22 gauge as per IS 655 and IS 277 for supply and return air systems as per the specifications given in the tender document . The flanges and supporting shall be as per IS 655. All the GI ducting should be hanged from walls/ beams/ roof with the help of MS angles/ tie rods or supported on roof with proper MS stand as mentioned in the tender document. The cost of duct supports shall be included in the cost indicated for ducts. All the duct supports should have two coats of primer and black enamel paint after necessary anti rust treatment. Necessary gasket is also in the scope of contractor. Leakages in the ducts shall be as per standards. The necessary MS support &amp; civil grouting for the support is included in the scope of work. Ducting shall be made in circular or square shape as per the site requirement.</p>	300	Square Meter		0
4	<p><b>ACOUSTIC INSULATION OF DUCTS</b> : Supply and Application of Acoustic insulation for the initial portion of supply air ducting. Material of construction shall be fibre-free elastomeric nitrile rubber foam with open cell structure . The density of the same shall be within 140-180 Kg/m<sup>3</sup>. The material should have a thermal conductivity not exceeding 0.050 W/mK. The maximum surface temperature the material should withstand is 105° C and minimum temperature should be -20°C. The material should conform to Class 1 rating for surface spread of Flame as per BS 476 Part 7. The insulation material shall be stuck to the cleaned duct surface by factory pre-fixed cold adhesive. The material and installation methodology should be in accordance with the specifications. Thickness of insulation: 20mm.</p>	100	Square Meter		0

5	<b>THERMAL INSULATION OF DUCTS (UN EXPOSED) :</b> Supply and Application of External Thermal Insulation of Supply Air ducting. Material of construction shall be cross linked polyolefin/ polyethelene foam material with closed cell structure and with factory applied reinforced aluminium foil. The density of the same shall be within 25 Kg/m3.The material should have a thermal conductivity not exceeding 0.032 W/mK. The insulation material shall be shall be stuck to the cleaned duct surface by factory pre-fixed cold adhesive. The material and installation methodology should be in accordance with the specifications. Thickness of insulation:25mm.	150	Squa re Mete r			0
6	<b>THERMAL INSULATION OF DUCTS ( EXPOSED ):</b> Supply and Application of External Thermal Insulation of Supply Air and return air ducting coming out side. Material of construction shall be cross linked polyolefin/polyethelene foam material with closed cell structure and with factory applied reinforced aluminium foil. The density of the same shall be within 25 Kg/m3.The material should have a thermal conductivity not exceeding 0.032 W/mK. The insulation material shall be shall be stuck to the cleaned duct surface by factory pre-fixed cold adhesive. The finishing will be carried out with fixing 200 gsm glass cloth with the help of adhesive Fevicol lag coating (AF 5590) . Finally it will be painted with synthetic enamel paint. The material and installation methodology should be in accordance with the specifications. Insulation shall be of 25 mm thick with 200 GSM glass cloth finishing.	150	Squa re Mete r			0
7	<b>Aluminium SA grills:</b> Design , supply , installation , testing and commissioning of 2 way deflection type Aluminium SA grills /Diffusers powder coated of minimum thickness 0.8 mm along with all necessary hardware with VCD. The other details are as per technical specifications.	8	Squa re Mete r			0
8	<b>Aluminium RA diffusers:</b> Supply , installation , testing and commissioning of Aluminium return air Grills/diffusers powder coated of minimum thickness 0.8 mm along with all necessary hardware. The other details are as per technical specifications.	8	Squa re Mete r			0
9	<b>COPPER REFRIGERANT PIPING:</b> Supply, Installation and Testing of Refrigerant piping consisting of Suction/ Liquid line piping and fittings with 19 mm thick closed cell elastomeric / XLPE insulation and finished with polyshield coating with at-least two coats of resin and hardner . The piping shall be carried out with hard drawn copper pipes with soldered / brazed socket fittings. Complete piping workmanship to be carried out as per recommended practice. The piping to be vaccum tested and leak tested. Scope includes refrigerant pipes shall be properly laid in GI tray supported and anchored to the building structure using steel hangers, anchors, brackets etc which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number as per following sizes pipes:					

10	Copper refrigerant piping , 5/8" dia	60	Rmt			0
11	Copper refrigerant piping , 5/8" dia	60	Rmt			0
12	Copper refrigerant piping , 1 3/8" dia	60	Rmt			0
13	<b>N2 Pressure testing &amp; R-134a Gas charging for 11.0 TR Condensing unit</b>	3	Nos.			0
14	<b>Electronic remote control</b> to operate AHU fan and condensing units etc	3	Nos.			0
15	<b>ELECTRICAL CABLING ( POWER CABLING) :</b> Supply, Installation, Testing & Commissioning of BIS Certified FRLS , PVC insulated Armoured Copper Power Cables of suitable ratings/sizes between the distribution board, AHU, ERV and Condensing Units including lugs, crimping and terminations identifying labels duly clamped.	200	Rmt			0
16	<b>ELECTRICAL CABLING ( CONTROL CABLING):</b> Supply, Installation and Testing of BIS certified PVC insulated Armoured FRLS copper control cable OF suitable rating/size interconnecting the indoor and outdoor units.	200	Rmt			0
17	<b>GI EARTH STRIP:</b> Supply, Installation and Testing of 3 mm thick one inch GI FLAT earthing .	50	Rmt			0
18	<b>CONTROL CUM DISTRIBUTION PANEL:</b> Supply, Erection, Testing and Commissioning of MV control cum distribution panel of Indoor, free standing floor mounting type, 3 ph/415 V 4, wire dust and vermin proof by construction of 14 SWG CRCA sheets, treated with 7 tank process, painted with epoxy powder coating, compartmentalised, modular type with IP 42 Protection. Incomer: 1No - MCCB with ROHM arrangement, 1 Set of Current transformer, 1 No - Digital Multi data Meter with dual reading arrangement for volt, Amps, PF & Energy ,1 Set - LED type RYB indication lamps with control fuses ,6A Four Pole control MCB with neutral link. Outgoing - 1 ( 3 nos of A H U ) : 3 ph star-delta starter (fuse less protection) motors exceeding 5.5 KW or DOL upto 5.5 KW, suitable MCCB, power contactor, bi-relay, timer, under voltage trip, overvoltage trip, single phase prevention, phase reversal unbalanced load trip relays, on/off push button, indicator lamps, auto manual operation . Outgoing - 2 (3 nos of condensing units): Multiple feeders for Condensing units with 63ATPNMCCB, suitable TPN Aluminium Bus Bar ( TPN+E Electrolyte grade) and associated accessories as required. The MV panel shall have 2 spare cubicle one for the AHU and the other for condensing unit. Include potential free contacts as and when required. MV Panel suitable for 3 Nos 11 TR AHU-4400 CFM-100 MM ST.PR,3 nos. 11.0 TR DX air-cooled condensing units and ERV.	1	Nos.			0

19	<b>PVC DRAIN PIPE:</b> Supply, Installation and Testing of Hard PVC drain piping insulated out of Class 0 closed cell elastomeric nitrile rubber material of approved make as per specification complete with supports, consumables, fittings, pipe sleeves, U trap, leak arresting of following sizes. 32mm dia (19 mm thick insulation)	20	Rmt			0
20	<b>WIRE MESH:</b> Supply and erection of suitable wire mesh and cowl for fresh air .	5	Square Meter			0
21	<b>DAMPERS:</b> Supply, installation, testing and commissioning of Factory fabricated low leakage volume control/duct dampers of Aerofoil-blade Aluminium dampers with compressible jam seals and extruded-vinyl blade edge seals, in opposed-blade arrangement with steel operating rods rotating in nylon bearings mounted in a single extruded aluminium frame, and with hard PVC/Nylon gear arrangement for common linkage between blades. Frames and blades to be constructed from high quality extruded aluminium sections. Frame with flat frontal face to suit flanged connections with the ducts. Frames to be screw fixed and sealed to eliminate casing leaks. Blades to be pivoted on PVC bushes and operated through PVC gear system to be fully enclosed within the damper frame.	5	Square Meter			0
22	<b>STRUCTURAL FABRICATED STEEL WORK:</b> Supply, Fabrication , Cutting, Welding , Erection at site and painting of M. S. Angle structural steel work for required truss, outdoor unit location etc based on the approved drawings. The work should be carried out as per good manufacturing and installation practices in concurrence with approved drawing. The structural steel materials should confirm to IS: 2062 (latest version) as per drawings. All welding electrodes to confirm to relevant IS codes. Fabrication and erection of the structural steel works shall be as per IS : 800 and welding work as per IS:816 and IS : 822. Finally all steel work to be painted with one coat of zinc chromate primer and two coats of synthetic enamel paint.	400	kg			0
23	<b>Dismantling and shifting of old blowers , pumps, chillers and filters of existing AC central plant</b>	1	set			0
24	<b>Dismantling and cutting of old damaged ducting</b>	250	Square Meter			0
	Reamrks: 1) Arranging suitable scaffolding is also in the scope of the contractor. 2) Contractor is advised to visit the C.LAB site and see the locations, systems etc. to get the correct idea of work and material requirement before quoting.				Total	0

NOTE: The above quoted value is exclusive of ESI,EPF and service Tax

NAME OF THE CONTRACTOR

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AADHAR CARD NO

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PAN NO

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BANK A/c NO

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AADHAR CARD NO

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PAN NO

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BANK A/c NO

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SIGNATURE OF CONNTRACTOR WITH SEAL

