



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
KHARAGPUR, WEST BENGAL 721302

TENDER DOCUMENT

for

**SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR
CONDITIONING WORK FOR PROPOSED XEV LABORATORY AT 2ND
FLOOR AT CRR BUILDING, IIT KHARAGPUR**

NIT No: IITKGP/IW/RAC/CRR/2018-19 DATED 07.02.2019

Tender Serial No. _____ Issued to:

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1. NOTICE INVITING TENDER

1.1. INTRODUCTION

Indian Institute of Technology (IIT) Kharagpur, hereinafter called IITKGP, invites sealed tenders from the eligible contractors for **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR PROPOSED LABORATORY AND SEATING AREA AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR** Particulars of the project are as following.

1.2. PARTICULARS

1.NIT Number	NIT No. IITKGP/IW/RAC/CRR/2018-19
2.Name of Work	SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR PROPOSED LABORATORY AND SEATING AREA AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR
3.Location of Work	AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR, West Bengal 721302.
4.Estimated Cost(including GST)	₹ 1971164.00 /- (Rupees Nineteen Lakhs Seventy one Thousand One Hundred and Sixty four Only)
5.Earnest Money Deposit	₹ 39,500.00 (Rupees Thirty nine Thousand Five Hundred Only)
6.Time Limit	70 days.
7.Tender Fee	₹ 500/- (Non-refundable)
8.Tender Basis and Mode	Two stage(Technical Bid & Financial Bid)
9.Mode of Payment to IITKGP(EMD/Tenderfee)	Demand Draft / Pay order in favour of IIT Kharagpur payable at Kharagpur.
10.Date, Time & Venue of Pre-bid Meeting	19 th February 2019, 1130hrs, Estate(E&M) Meeting Room, 1st Fl, Old Bldg, IIT Kharagpur. Site visit shall be done on same day after the pre-bid meeting if required.
11.Closing Date & Time for Receipt of bids	28 st February 2019 up to 1500hrs
12.Date & Time for Opening of Technical Bid	28 st February 2019 at 1630hrs
13.Date& Time for Opening of Price Bid	To be intimated to the eligible bidders subsequently.
14. Engineer-in-charge and contact details.	Mr .Soumitra Banerjee, Engineer RAC Tel: 03222-282724, Email: sbanerjee@adm.iitkgp.ac.in
15. Address for tender issue, submission and opening	Office of SE(E&M), 1 st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302
16.Website for full and updated information	https://eprocure.gov.in/cppp/tendersearch; http://www1.iitkgp.ac.in/topfiles/tenders.php

1.3. ELIGIBILITY CRITERIA

- 1.3.1. The bidder must be registered in appropriate class of works with Government organization like CPWD/ PWD/ MES or PSUs or those having experience in similar nature of works awarded by Government / Semi Government Organizations/ Government Funded Autonomous Organization.
- 1.3.2. The bidder must have done at least 1 (ONE) similar work of value of 80% of the estimated cost for HVAC works **or** 2 (TWO) similar works for projects each of value 60% of the estimated cost for HVAC works **or** 3 (THREE) similar work for projects each of value 40% of the estimated cost for HVAC Works with Government/Semi-government/ PSU/ Government Funded Autonomous Organization during last **7 (seven) years** preceding last date of the month of tender submission.
- 1.3.3. The Bidder should have registered Sales & Service office in Kolkata with adequate manpower. List of tools and tackles and resume of the workmen may be provided in the technical BID. Firm should have full-fledged service set up in Kolkata. Organization chart of the service set up should be furnished duly signed by authorized signatory.
- 1.3.4. Either the bidder or his authorized dealer/ Service provider can bid for the tender. An authorization certificate may be produced along with technical Bid.
- 1.3.5. Firm should have valid ISO certification. ISO certificate shall be furnished.

Note:

- (i) The estimated cost is ₹ **1971164.00** /- (Rupees Nineteen Lakhs Seventy one Thousand One Hundred and Sixty four Only)
- (ii) The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to the last date of receipt of applications for tender.

(iii) **Similar works shall means:** Supply installation testing commissioning of Air conditioning system.

1.3.6. Special condition for associate consultant:

This work includes an item in Part II of BoQ for detailed design and drawing work including structural and architectural, electrical, S&P. Bidders shall associate themselves with the consultant eligible for comprehensive consultancy work at least for 1 (one) similar project costing 80% of the estimated cost or 2 (two) similar projects for each value 60% of the estimated cost or 3 (three) similar projects each value 40% of the estimated cost.

The bidder has to submit document in support of eligibility of their associate consultant.

- 1.3.7. The bidder or the specialized agency the bidder intends to associate with must be registered with appropriate government authority as a bonafide business entity and must have GST registration certificate and Permanent Account Number of income tax.
- 1.3.8. Electrical work shall be executed by selected bidder through agency holding electrical license and electrical supervisor license valid on date of execution.
- 1.3.9. The validity of the registrations and licenses should be valid as on the date of tender submission.
- 1.3.10. Average annual turnover of the bidder as per ITCC or profit & loss statement shall not be less than 30% of the estimated cost, not having incurred loss in more than two years, during last 5 years ending 31 Mar 2018.
- 1.3.11. Bidder must hold solvency certificate from any scheduled banks for a minimum value of 40% of the estimated cost, issued not earlier than 6 (six) months from the last date of submission.

1.3.12. Special condition for HVAC related Electrical and Civil Work:

The scope of HAVC shall include following civil and electrical work-

- Opening /Closing / Making hole in existing Masonry wall/ Concrete / Glass structure to facilitate entry and exit of duct / pipe work and finishing it good.



1. Quality of above works shall be assessed by the bidder before quote as per his scheme of execution.
2. All above work shall be executed and finished good to the satisfactory of Engineer- in-charge.

Sd/-

Superintending Engineer (E&M)

On behalf of the Director, Indian Institute of Technology Kharagpur

Copy to:

- 1) Registrar
- 2) Chief Engineer
- 3) Engineer (RAC)
- 4) Assistant / Junior Engineer (Civil/ E&M)
- 5) Notice Board
- 6) Office file



1. INFORMATION TO BIDDERS**A. SCOPE OF WORK**

Indian Institute of Technology intends SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR PROPOSED LABORATORY AND SEATING AREA AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR.

The job needs to be executed adjacent to busy traffic area (vehicular/ pedestrian) without causing any disturbances to the normal traffic circulation. Adequate/ safe barricading has to be ensured to segregate construction zone from public circulating area.

- i. The scope of work under this tender comprises the supply, installation, testing and commissioning of Low side Work for HVAC System conforming to the specifications and in accordance with the details of the Bill of Quantity (BOQ) and the drawings issued. The work shall include all minor and incidental items necessary for the proper functioning of the complete system, even though not specifically detailed or mentioned herein.
- ii. The vendor shall work out execution sequence and methodology so as to complete the project within the envisaged time and the estimated cost, duly handling the constraint mentioned above. *Details of other scope of work are listed at Annex II & III.*
- iii. Detailed scope of work is further listed as under: **Particular Conditions**
- iv. Submission of all Shop Drawings, Material Data Sheets and Performance details
- v. Submission of all final documentation including all Test-Reports, Catalogues Instruction Manuals, O & M Manuals, 'As Built' drawings and all other applicable documents as part of Handing-Over process.
- vi. Necessary interface with the IBMS system of the Purchaser including all the hardware required for the same as per I/O summary to be finalised.
- vii. On-site training and familiarization of the Client's operating staff for a period not less than one week in the overall operation of the installed systems
- viii. The proposed drawings are enclosed from **Annexure II**

B. GENERAL INSTRUCTIONS

- i. Bidding documents are to be obtained electronically through websites: <https://eprocure.gov.in/cppp/tendersearch>; <http://www1.iitkgp.ac.in/topfiles/tenders.php>. The tender fee in the prescribed mode must accompany the tender documents issued electronically at the time of submission.
- ii. This bid document shall be read in conjunction with GCC (General Conditions of Contract) available on <http://www1.iitkgp.ac.in/topfiles/tenders.php>.
- iii. The bidder shall visit and inspect the site and obtain all information on his own responsibility and at own cost, which may be necessary for the purpose of quoting and submitting the tender. No excuse or ignorance as to site conditions and local information shall be accepted after awarding of the contract. Access to the site will be granted by the Engineer-in-charge on all working days within working hours.
- iv. IITKGP shall not provide any space at site for labour hutments.
- v. All clarifications about the tender shall be sought by bidder on or before pre-bid meeting. The bidders may make suggestions which shall be considered during the Pre Bid Meeting. Intending bidder(s) may also send their queries or suggestion, if any, through e-mail to the Engineer-in-charge on sbanerjee@adm.iitkgp.ac.in on or before **19th Feb 2019 11.30AM**. No queries shall be entertained after notification of replies to noteworthy queries received till the date of pre-bid meeting.
- vi. Completion certificate issued by Competent Authority will only be considered as credential. If the Completion certificate issued by Competent Authority does not reflect the type of work, then Final bill / Schedule of Quantity of the qualifying works also to be attached along with the Completion certificates. Certificate from private individuals / organizations for whom such works have been executed shall not be accepted.
- vii. The bidding document (consisting of specifications, the schedule of quantities of various types of items to be executed, the set of terms and conditions of the contract and other documents / drawings, if any), Corrigenda, Clarifications to Pre-bid queries can be downloaded from the websites: <https://eprocure.gov.in/cppp/tendersearch>; <http://www1.iitkgp.ac.in/topfiles/tenders.php>. Corrigenda, if any shall be published only on these websites. The institute shall not be responsible for any delay / difficulties / inaccessibility of downloading facility for any reason whatsoever.
- viii. All costs, charges & expenses that may be incurred in connection with the preparation of his tender shall be borne by him and the Institute accepts no liability whatsoever therefore.





- ix. Rates quoted by the bidders shall be inclusive of GST (Goods and Services Tax - Central, State and Interstate) and all applicable taxes. Income Tax and all other statutory deductions like labour cess etc. will be deducted from the bill as per prevailing rules.
- x. Exemption to IITKGP against any tax/ duty/ fee/ surcharge/ charge/ cost, if any, found applicable or sought later from IITKGP after award shall be passed on to IITKGP by the contractor without dispute.
- xi. IITKGP reserves the right to reject any or all of the bids without assigning any reason.
- xii. **Bid Validity:** Bid shall remain valid for 120 days from the date of submission.
- xiii. **Firm Price: Bidder's quoted Rates/Prices for executing the activities under the Contract shall remain firm till completion of the entire work & shall not attract any escalation under any circumstances whatsoever.**
- xiv. If any information furnished by the bidder is found as false / fabricated, then his bid will be rejected and treated as cancelled. Even if the such manipulation is detected at any stage after signing of the contract, it would lead to termination of the contract besides forfeiture of Earnest Money Deposit and liabilities towards prosecution. In such cases the bidder will be debarred from participation in future tendering process in IITKGP for next 05 (Five) years.
- xv. **Earnest Money Deposit (EMD)** of requisite amount and that in prescribed mode or proof of payment thereof shall be enclosed with the Technical Bid explained in following section.
- xvi. **Refund / Conversion of Earnest Money Deposit:** The Earnest Money received shall be refunded to the unsuccessful bidders without any interest after the opening of financial bids. The Earnest Money Deposit of successful bidder shall be retained and converted into part of Security Deposit.
- xvii. **Forfeiture of Earnest Money Deposit:** Earnest Money Deposit will be forfeited in any of the following cases:
 1. The bidder withdraws / modifies his tender during the period of Bid Validity.
 2. The bidder, in case of tie between lowest bids, refuse to submit revised offer.
 3. The bidder does not accept the correction of arithmetical errors of his tender.
 4. The bidder fails to deposit Performance Guarantee and information as per format given in GCC within the stipulated time period before award of the work.

C. SUBMISSION OF TENDER

- i. The sealed tenders shall be received at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302, up to 1500hrs, 28st February'2019 or Corrigenda otherwise.
- ii. Tenders received after the due date and time shall not be considered.
- iii. Tenders shall be submitted in a sealed Master envelope super scribed "SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR PROPOSED LABORATORY AND SEATING AREA AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR" with NIT No. IITKGP/IW/RAC/CRR/2018-19 as NIT No., containing three separate sealed covers, each clearly super scribed as "Tender Fee and EMD", "Technical Bid" and "Financial Bid" respectively, in the following manner:
- iv. **Envelope-1 (Tender FEE & EMD)** will consist of:
 - i) **Tender Fee for ₹ 500/- (Non-refundable), in the prescribed mode or proof of payment thereof.**
 - ii) **Earnest Money Deposit** of requisite amount in the prescribed mode or proof of payment thereof.
- v. Tender without payment of Tender Fee & Earnest Money Deposit would be summarily rejected.
- vi. **Envelope-2 (Technical Bid)** will consist of:
 1. Covering letter of the offer signed by firm's authorized signatory.
 2. Documents establishing the identity and authenticity of the bidder/ bidding firm
 3. Self-certified copies of all the documents in support of eligibility of bidder.
 4. Self-certified copies of all the documents in support of eligibility of proposed/associated agencies for specialized services.
- vii. **Envelope-3 (Financial Bid)** will consist of the complete tender document, each page duly signed and stamped by the bidder as acceptance of the conditions, Declaration by Bidder and **Financial Bid** all duly filled-in, signed by the bidder or his/her authorized signatory and stamped.



D. EVALUATION OF BIDS AND AWARD OF WORK

- i. The Bid of bidder will be opened on the specified date and time of opening at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302 in the presence of willing bidders or their authorized representatives.
- ii. Date, time and place of opening of Financial Bid will be informed after evaluation of Technical Bid to the Technically Qualified Bidders.
- iii. Bids shall, first, be checked for payment of **Tender Fee** and **Earnest Money Deposit**. Only those bids found to have duly paid/ submitted Tender Fee and Earnest Money Deposit shall be considered for evaluation.
- iv. Evaluation of **Technical Bid**: The bids received will then be assessed on the eligibility criteria mentioned at para 1.3 of Notice Inviting Tender. Bids found not meeting the eligibility criteria shall be considered non-responsive and shall be rejected summarily.
- v. IITKGP retains the right to revert back to individual bidders with further clarifications / queries on the Technical Bid. The bidder has to respond to the queries within the specified time mentioned in the covering letter.
- vi. On the date & time specified for opening of Financial Bid or the Revised Financial Bids as the case may be will be opened on specified date and time.
- vii. **EVALUATION OF Financial Bids**: The Financial Bid should contain the complete bid document with duly filled in Schedule of Financial Quote. Financial Bids opened as above will be checked for arithmetical errors.
- viii. The successful bidder shall be issued Letter of Acceptance (LOA) of the bid, and be required to furnish a Performance Guarantee as per General Conditions of Contract, Program Schedule with specific Milestones to be achieved as to complete the work within the stipulated time limit and details of his Technical Staff to be deployed as per ANNEXURE-I
- ix. **Letter of Award (Work Order)** shall be issued to the successful bidder only after receipt of the Performance Guarantee, along with Program Schedule and the details of Technical Staff to be deployed for the work.
- x. **Agreement (Contract)** consisting of complete tender document including conditions, bill of quantities, technical proposal and specialized services, drawings, if any, and acceptance thereof together with any correspondence leading thereto, shall be drawn and signed with the awardee within 10 days of the Letter of Award.
- xi. **Date of start** of work shall be reckoned from the 7th day of the issue of the Work Order.
- xii. **Defect Liability Period (DLP)**: In partial modification to clause no.16 of General Conditions of Contract (GCC), the Defect Liability Period shall be 12 months after the certificate final or otherwise of its completion of work or till the final bill has been prepared.

C. TERMS OF PAYMENT:

- a. 70% towards supply of materials at site.
- b. 20% towards installation.
- c. 5% towards successful commissioning and handing over with all test reports and as-built drawings approved by IIT- Kharagpur.
- d. 5% towards retention amount till the completion of Defects Liability Period.

Period of payment will be minimum 60 days from the date of submission of bills.

2. UNDERTAKING BY THE BIDDER**UNDERTAKING**

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

I / We, hereby tender for execution of the work specified for the Indian Institute of Technology Kharagpur within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for 120 days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of Rs. ----- has been deposited in cash / demand draft of a scheduled bank / Pay order as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said Director, Indian Institute of Technology Kharagpur or his authorized officer shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that the Director, Indian Institute of Technology Kharagpur shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by 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.

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

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

Seal & Signature of Contractor

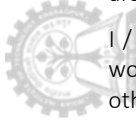
Postal Address

Dated

Witness

Address

Occupation



ANNEXURE-I

3. TECHNICAL STAFF OF CONTRACTOR

DISCIPLINE	NAME	QUALIFICATION	EXPERIENCE	CONTACT NUMBER
Overall Project In-charge				
Engineer - Structure and Civil Works				
Engineer – Electrical & Mechanical Works				
In-charge - Safety, Health & Environment				

Seal & Signature of Contractor



भारतीय प्रौद्योगिकी संस्थान खड़गपुर

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

4. PARTICULAR CONDITIONS

Indian Institute of Technology intends air-conditioning of the fibre optic system lab of E&EC department at 1st floor. The application of the lab shall be clean room application to support Micro-/Nano- Robotics fabrication and characterization facility.

1. AIR-CONDITIONING

DESIGN CRITERIA

1.1 OUTDOOR DESIGN CONDITIONS :

Outdoor Design Conditions for Kharagpur are based on Weather data compiled and published by ISHRAE (WeDCo) for Kolkata and past experience corresponding to 2 % annual cumulative frequency of occurrence and the outdoor design conditions have been considered as follows:

Design Conditions	DRY BULB		Mean Coincident WBT		RH
	Deg F	Deg C	Deg F	Deg C	%
SUMMER	110	43.3	83	28	33
MONSOON	94.4	34.66	82	28	60
WINTER	56	13	48	9	55

1.2 INDOOR DESIGN CONDITIONS

Based on past experience, indoor design conditions for centrally air-conditioned spaces shall be as follows:

SPACE	Temperature Deg C	Relative Humidity %	Remarks
Student sitting area	26±1.1	60±10 % at full load condition	
Lab area	23±1.1	70±10 % at full load condition	

Note: Winter Heating is not envisaged.

1.3 MECHANICAL VENTILATION

Area	Air Changes Per Hour(ACH) as per NBC	Remarks
Toilets	15	

1.4

BUILDING CONSTRUCTION DATA

The Building construction data for calculating the building air-conditioning load is as below.

- i. External Wall : $U = 1.81 \text{ Watt / Sqm}^{\circ}\text{C}$
(0.32 Btu / HrSqft^oF) (230mm thick brick wall)
- ii. Roof (Exposed to sun) : $U = 1.316 \text{ Watt / Sqm}^{\circ}\text{C}$
(0.23 Btu / HrSqft^oF)
- iii. External Glass Specifications : Glass with following details:
 $U = 5.8 \text{ Watt / Sqm}^{\circ}\text{C}$
(1.02 Btu / HrSqft^oF)



Solar heat gain Coefficient: 0.8

1.5 OCCUPANCY AND INTERNAL HEAT GAIN

SPACE	Occupant Density	Equipment Load	Lighting Load	Fresh Air
Student sitting area	75sft /person	125W/ Person	Average 1 W/sft	Asper ASHRAE 62.1 2004 or ACPH @1.5 , whichever higher
Fiber Optic Lab	5 persons	4kW	Average 1.5 W/sft	Asper ASHRAE 62.1 2004 or ACPH @1.5 , whichever higher

2. COOLING ESTIMATE

Estimated cooling loads are tabulated in table-2.

TABLE -2

PRELIMINARY COOLING ESTIMATE FOR LABORATORY & SEATING AREA - KHARAGPUR

SL. NO	FLOOR	AREA PARTICULARS	AREA (sqft)	PERSON	EQUILOAD (kW)	COOLING CAPACITY (TR)	D/CFM	IDU CAP
1	2 nd Fl	LABORATORY & SEATING AREA	2927	20	1.5	22	10000	1 x 22.0 TR floor mounted AHU with condensing unit
TOTAL			6441					

3. PLANT SELECTION

Air conditioning of this lab shall be done with floor mounted DX type Air Handling unit (AHU) and the AHU shall be connected with energy efficient scroll compressor in air cooled condensing units. Multiple scroll compressor in the condensing units shall be grouped together to get the benefit of overall part load operation at of peak hours, seasonal & daily temperature variation.

The area is to be air-conditioned by 2 X 11TR air cooled outdoor unit and the AHU capacity shall be 10000cfm. The outdoor unit and AHU shall be placed roof of the building as per the suit at site condition.

4. Additional scope need to be considered by AC vendor:

- Any type of civil work like foundation of outdoor unit, any wall cutting and making same good etc.
- Drain to be terminated to the nearest drain point.
- Any type of painting related to HVAC work if required.

All signal/control/power wiring/Earthing (from nearest existing earthing)related to HVAC system are included in HVAC scope of works including their terminations.

TEST READINGSITEM

AIR-COOLED OUTDOOR UNIT

MOTOR

AIR HANDLING UNIT

SUPPLY & RETURN AIR GRILLES

SPACE TEMPERATUTRES

TEST READINGS TO BE TAKENAT THE TIME OF COMMISSIONING

Refrigerant pressures

Oil pressure

BHP consumed at 100% Load

Ambient Temp

Voltage & Amperage

Entering/leaving Air Temperatures DBT/WBT

Air flow rates

Air flow rates

Supply air DBT/WBT

DBT/WBT/RH



Technical specification of Air Handling Unit**1.0 Scope**

1.1 Supply Installation, testing and commissioning of the split air-conditioners meeting in all respects the intents of the specifications. The supply of the units shall comprise:

- a) Out door unit
- b) Indoor Unit (AHU)
- c) Refrigerant piping connecting the two and drain piping
- d) Electrical wiring from the socket – outlet through the indoor and outdoor units with provision for local remote control.

2.0 Outdoor Unit

2.1 The outdoor condensing unit shall comprise a compressor, condenser coil, condenser fan, refrigerant connections and a casing. The compressor shall be hermetic type resiliently mounted for quiet operation. The compressor drive shall be a single phase motor refrigerant cooled and shall have an inbuilt over load protector. The unit shall be capable of frequent starting and stopping without causing any over load.

2.2 The condenser coil shall be a copper tube with aluminium fins. The tube diameter shall be not less than 10mm with a wall thickness of 0.4 mm copper. Tube shall have aluminium fins adequately bonded through a process of mechanical expansion. The number of fins shall not exceed 520 per meter (13 per inch) and the number of rows in each case shall be for the specified output. The condenser fan shall be a multi-blade propeller type designed for low noise and directly driven by a totally enclosed fan motor. The refrigerant connections shall be brought out into plain stub ends.

2.3 All the components shall be enclosed in a casing formed from heavy gauge 1.6mm galvanized sheet steel totally rust inhibited.

3.0 Air Handling unit:

3.1 The Air Handling unit shall be floor mounted type and suitable for outdoor installation. The unit shall consist of following specification:

Outer skin	0.8 mm Pre- coated GI
Inner Skin	0.8 mm Plain G.I
Frame work	Thermal break Al profile with thermal barrier.
Thickness of insulated panels	43 mm thick, CFC Free PUF injected (Density: 40 kg / Cu. m.)
Material of Drain pan	20 G SS-304 Tray duly insulated with 13 mm closed cell Nitrile insulation.
Unit Base	G.S.S base channel

DX COIL: (R-410)

Make Of Coil	As per approved make
Coil Casing / Blank offs	GI
Material Of Tube	Copper
Tube Dia (mm / inch)	9.52 mm / 3/8" O.D.
Thickness of tube (SWG / mm)	25 SWG / 0.50 mm



Header Material	Copper
Thickness & Material of fins	0.15 mm Plain Aluminum
No. of Fins per inch (FPI)	11 / 12

FAN & MOTOR:

Fan make	Comefri / Kruger/Nicotra
Motor make	ABB / CROMPTON /BHARAT BIJLEE

DOUBLE SKIN FLOOR MOUNTED HORIZONTAL AIR HANDLING UNIT SHALL HAVE: (with weather proof canopy)

- Mixing box with manually operated FA & RA damper in Al constructions.
- Filter section with 50 mm thick (EU-4) box type pre filter mounted on GI filter frame.
- Coil section with 6 row deep DX cooling coil with single number of distributor.
- Fan section with imported DIDW centrifugal backward curved fan, Drive set with V-belt & Motor (EFF-1).

OPERATING PARAMETERS:

Air Qty(CFM)	9000
SP (mm wg)	50
Unit Model	Vendor to specify
Fan Type	Backward curve
Fan Diameter	Vendor to specify
Fan Speed (RPM)	Vendor to specify
Fan Outlet Velocity (m/s)	Less than 10
Shaft Absorbing Power (Kw)	Vendor to specify
Motor Rating (kW)	3.7±10% (approx.)
Coil Area(Sq.ft)	Vendor to specify
Cooling Coil RD	6
Coil capacity	22.0
Distributor	1
Filter area (sq. ft)	Vendor to specify
Length (mm)	Vendor to specify
Width (mm)	Vendor to specify
Height (mm)	Vendor to specify





4.0 Installation

4.1 The outdoor unit shall be installed as decided by the Indian Institute of Technology- Kharagpur. The indoor unit shall be ceiling suspended as shown on drawings/ as per the requirement of client.

4.2 Refrigerant lines shall be inconspicuously and generally as shown in the drawings and as directed on site. The suction and liquid lines shall be bonded together and insulated with 6mm thick elastomeric tubing. All power wiring shall be drawn from the nearest socket outlet and shall include the control wiring, power wiring, on-off switch with speed controller.

4.3 All pipe sizing shall be done taking into account the length and rise.

4.4 A 25mm insulated drain pipe shall be provided as shown on the drawing and as directed on site.

5.0 Testing

5.1 The unit shall be tested for establishing the capacity and power consumption. Tests shall be carried out in accordance with IS 5141 – 1969 (revised upto date) computed results shall tally with specified capacity and power consumption figures furnished with the tender offer.

5.2 On completion of piping the system and the piping shall be tested using Nitrogen gas by raising the pressure to 1.5 times the working pressure and holding the test pressure for 3 hours.

5.3 Tests shall be carried out on

- a) the compressor and drive motor side
- b) condenser side for heat rejection
- c) Cooling coil for cooling capacity
- d) Evaporator air volume

5.4 A test certificate from prototype factory tests will be acceptable.

6.0 Mode of Measurement

6.1 Each unit shall be measured as one item of work which shall consist of:

- i) Outdoor unit
- j) Indoor unit
- k) Refrigerant and drain piping (with insulation)
- l) Electrical power control wiring, room thermostat and control panel
- m) Refrigerant charge & oil
- n) Erection
- o) Commissioning and testing

7. REFRIGERENT PIPING.

7.1 Scope.

The scope of this section covers supply, installation of refrigerant piping & drain piping with insulation as specified here & as shown in the drawings.

7.2 Refrigerant copper Piping

- 16/18 gauge/ recommendation of OEM copper tubing shall be used to make connections to equipment's wherever required.
- Flare fittings e.g. flare nuts; tees, elbows, reducers etc. shall be of brass.
- The pipes and fittings shall be connected by means of welded joints. The connections to gauges, controls etc. (if any) shall be with soft copper tubing and flare fittings.
- Refrigerant piping routing shall be decided by Engineer – in – Charge.
- The refrigerant piping installation shall be as per drawing.

7.3 **Drain Piping.**

- All condensation drainage shall be pitched in the direction of flow to ensure adequate drainage with an adequate trap seal to prevent leakage / infiltration.
- Provide pitch of 20 mm per meter for a smooth drainage of condensate.
- Condensate drain piping fixing shall be as per drawing.
- The routing of Drain Piping shall be decided by Architect/ Engineer – in – Charge.
- The material for the drain pipe is GI.
- Drain piping supporting shall be as per drawing.

7.4 **Suction Line Insulation**

The Suction Line shall be insulated with 19/25 mm thk. Nitrile Rubber Insulation covered with aluminium foil (As per Specified with K Value of 0.027-0.029 K Cal/Hr.MDeg C at 0-16 Deg C)

7.5 **Drain Piping Insulation**

The drain pipes shall be insulated with 6mm thick Nitrile Rubber Insulation.

7.6 **Mode of Measurement**

- Refrigerant pipes with insulation shall be in linear measure along the center line of the pipe including accessories, supports etc and paid for per RMT.
- Condensate drain pipes with insulation shall be in linear measure along the center line of the pipe including accessories, supports etc and paid for per RMT.

**AIR DISTRIBUTION**1.1 **Scope**

The scope of this section comprises of supply, fabrication, installation and testing of all sheet metal ducts and supply, installation, testing and balancing of grilles and diffusers, in accordance with these specifications and the general arrangement shown in the drawings. The duct work will conform to IS standards/codes and relevant ASHRAE Guidelines. For this purpose it is contractors responsibility to arrange at site all necessary equipments like drilling machine, welding machine, etc. and necessary work force. The duct rates mentioned in the BOQ are inclusive of nuts, bolts, sheets, supports, gaskets etc. complete and duly installed.

1.2 **Duct Material**

The material for various application of air distribution ducting shall be as follows : -

Application	Material
1) Air Conditioning.	Cold rolled sheets continuous galvanised with a zinc coating of 120GSM as per IS: 277 – 1977.
2) Supports & Duct Flanges.	Mild Steel Structural Steel Sections.
3) Gasket.	Foamed rubber.
4) Bonding	Mastic Sealant.

1.3 Duct Fabrication.

The ducts shall be fabricated from galvanised steel sheets (GSS) class VIII conforming to ISI:277 – 1962 (revised) or aluminum sheets conforming to IS:737 – 1955 (for aluminum ducts, if any). The thickness of the sheets should be as follows :

Thickness of Sheets for Rectangular Duct Construction.

Maximum Side	Thickness of Sheets	Gauge
Upto 750 mm.	0.63 mm	24
From 751 to 1500 mm	0.80 mm	22

Maximum Size. (mm)	Minimum Thickness (mm)	Transverse Joint.	Bracing.
Upto 300	0.63 (24 SWG).	S-Drive, Pocket or bar Slips on 2.5 m centers.	None.
301 to 600	0.63 (24 SWG)	S-Drive, Pocket or bar Slips on 2.5 m centers.	None.
601 to 750		S-drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres.	25X25X3 mm angles, 1.2 mm from joint.
751 to 1000	0.80 (22 SWG)	Drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres.	25X25X3 mm angles, 1.2 mm from joint.
1001 ot 1500		40X40X mm angle conn- -ections, or 40 mm pocket bar slips with 35X3 mm bar reinforcing on 2.5 m centers.	40x40X3 mm angles, 1.2 mm from joint.
1501 to 2250	1.00 (20 SWG).	40X40 mm angle connec- -tions, or 40 mm pocket or -mum center with 35 X 3	40x40X3 mm or40X40X3 mm From joint.
2251 and above.	1.25 (18 SWG).	40X40 mm angle connec- -tions, or 40 mm pocket or 40 mm bar slips, 1 m maxi- -mum center with 35 X 3 mm bar reinforcing.	40x40X3 mm diagonal angles, or40X40X3 mm angles, 60 mm From joint.



1.6 All duct shall be fabricated and installed unless otherwise stated as per IS : 655 – 1963 with amendment – 1 (1971 edition.)

Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight. The gauges, joints and bracing for sheet metal duct work shall further conform to the provisions as shown on the drawings. The internal ends of slip joints shall be made in the direction of air flow. Ducts larger than 1000 mm shall be cross-broken. Duct sections upto 1200mm length may be used with bracing angles omitted. Tapering angle should not be more than 30°. Change in dimensions and shape of ducts shall be gradual. Curved elbows shall have a centre line radius equal to one and half of the duct. All Air turns of 45° or more shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes arranged to permit the air to make the turns without appreciable turbulence. Guide vanes shall be fabricated out of 0.63 mm (24 SWG) thick G. S. sheets and equally spaced on side runner to be riveted /bolted to duct sheets. Guide vanes shall be securely fastened to prevent noise or vibration. GI splitter dampers complete with brass metal lever shall be installed at each bifurcation/trifurcation point of duct for proper flow of air quantity in each duct. Joints, seams sleeves, splitters, branches, take-offs and supports are to be as per duct details as specified.

1.7 Duct Installations

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

During the construction the contractor shall temporarily close duct openings with sheet metal covers / polyethylene sheets to prevent debris-entering ducts and maintains them clean.

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

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

All duct work shall be of high quality approved galvanised steel sheet, guaranteed not to crack or peel on bending or fabrication of ducts.

All ducts shall be rigid and shall be supported from the ceiling / slab by means of MS Rods of 8 mm (3/8") dia with MS angles at the bottom as shown in the drawing. The rods shall be anchored to RC slab using Anchor/dash fasteners. A rubber gasket of 5 mm thickness shall be provided between duct and angle to avoid metal-to-metal contact and vibration. Double nuts will be provided under angle supports.

The hanger spacing for duct supporting shall be not more than 2 meter.

Where ducts touches with wall or ceiling or beams or columns or floor, a rubber gasket of 5 mm thickness shall be provided between them.

All flanges, bracing and supports are to be mild steel and are to be essentially given a coat of red oxide primer.

Fire retarding flexible canvas / Rexene connections not less than 100 mm and not more than 200 mm are to be fitted to the delivery of all IDU's.

1.8 Duct Supports.

Duct supports shall be as follows:

Duct Perimeter (mm)	Support.	Location.
Upto 1800	40 X 40 X 3 mm MS angle with 9 mm tie rod.	At Transverse Joints.
Over 1800 to 2500	40 X 40 X 6 mm MS angle with 12.5 mm tie rod.	At Transverse Joints.
Over 2500	50 X 50 X 6 mm MS angle with 15 mm tie rod.	At Transverse Joints.





1.9 Volume Control Damper (VCD) & Duct damper

- The Volume Control dampers & Duct Dampers shall be lever operated and complete with locking devices, which will permit the dampers to be adjusted and locked in any position, and clearly indicating the damper position.
- The dampers shall be of splitter, butterfly or louver type. The damper blade thickness shall not be less than 1.25 mm (18 gauge).
- Manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.6 mm thick galvanised steel sheets and blades shall not be more than 225 mm wide.
- For air balancing an opposed blade damper with quadrant and thumbscrew lock should be provided.
- At the junction of each branch duct with main duct VCD's must be provided. At the delivery of all IDU's VCD's must be provided.
- The dampers shall be of Extruded aluminium.
- Installation of VCD's shall be as per drawings.

1.10 Fire Damper

- Dampers could be fusible link type as indicated in BOQ.
- Fire dampers shall be provided at the delivery of all IDU's.
- The dampers shall be of multiple blade type. The blades shall be constructed with minimum 1.8 mm thick aluminium sheets. The frame shall be of 1.6 mm thick. Other materials shall include return spring, locking device and temperature sensor.
- Installation of fire damper shall be as per drawings.

1.11 Standard Grilles and diffusers

- The supply and return air grille/diffuser shall be fabricated from extruded aluminium sections of thickness not less than 1.5 mm. The supply air grille/diffuser shall have single / double louvers. The front horizontal louvers shall be of adjustable type. The rear vertical louvers shall be of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers.
- The damper blades shall also be of extruded aluminium. The grille flange shall be fabricated out of aluminium-extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.
- The ceiling type square/circular diffusers shall be of aluminium-extruded section with flush or step down face.
- All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom. (The centre portion should be spring loaded for easy removal and fitting).
- All grilles and diffuser shall be epoxy powder coated of 15 Micron in approved colour.
- Diffuser and grille shall be installed as per drawings.
- The linear grilles shall be provided with End Pieces at ends.
- Fresh air fan and fresh air intake as per BOQ.
- Measurement shall be as per neck size.

1.13 Testing and Balancing

After completion of the installation of the complete air distribution system all ducts shall be tested for air leaks. All dampers of supply air diffuser and supply air grille shall be balanced as per user's requirements. The entire air distribution system shall be balanced using approved anemometer.

1.14 Mode of Measurement.

All sheet metal ducting complete with duct supports, turning vanes, canvas connections erected in position shall be measured externally and paid per unit. All dampers shall be excluded in the duct area.

All manual control/splitter including Fire & Volume control damper sections with operations linkages, locking quadrant, sheet steel enclosure, frame, erection, supporting etc. shall be measured on the basis of quantity as mentioned in BOQ and will be paid as per unit rate.

Fresh air louvers with bird screen, damper, frame, ducting, erection & sealing shall be measured on the basis of quantity as mentioned in BOQ and will be paid as per unit rate.

Grilles/diffuser including volume control damper, installation etc. will be measured on the basis area and paid per unit area.

1. ACOUSTIC & THERMAL INSULATION**1.1 Scope**

The scope of this section comprises of supply, fabrication, installation and testing of Accoustic Material and Thermal insulation as per specification.

1.2 Duct Thermal Insulation

Thermal Insulation:

The ducts shall be insulated with 19mm thick Al foil faced nitrile rubber (Class: O). All joints shall be sealed with 50 mm wide adhesive based aluminium tape. The thermal conductivity of the material shall be not more than 0.032 **W/(m0 K)** and density not less than 33 kg/m3.

1.3 Duct Acoustic Insulation

Acoustic Insulation:

a. Acoustic insulation of duct shall be with 12 mm thick rigid board of fibre glass wool of density 48 kg/m3 and covered with 32 G Perforated Aluminium sheet and fastened with sheet by screw and washer with pitch not less than 12 inch.

b. Acoustic insulation shall be as per drawing after cleaning the internal surface of the duct to make it free from dirt and dust.

1.4 Mode of Measurement.

Acoustic Insulation shall be calculated on the basis of the prime duct size and paid for per unit area.

All duct thermal insulation shall be measured on the basis of duct prime surface area with addition of insulation thickness and paid for per unit area.

**8. ELECTRICALS****8.1 Scope.**

The scope of this section covers supply, installation & Testing of cables connecting Indoor Unit & Outdoor Unit as per specification.

8.2 Electrical.

- The supply should be complete with appropriate earthing as per IE Rules.
- Depending on the number and capacity of units to be installed, each unit should have separate control through a main incoming switch with adequate capacity of approved makes.
- Each ODU should have separate SFU adjacent to the unit / within the unit and visible from the unit.
- Electrical cabling should be done with armoured copper cable of approved makes only.
- Fuse switches should be HRC cartridge type with visible indication.
- The cabling shall be done as per drawings or instruction from Engineer – in –charge.
- The cabling supporting shall be done as per drawing.

9. Bidder need to submit the following data along with the technical bid:a. Outdoor Unit Technical Data Sheet:

Sl. No	Details of Technical Requirement	
1	Make	
2	Model	
3	Combination of Base Model (if Any)	
4	Actual Cooling Capacity at 41 Deg C (TR)	
5	Total Power Consumption at 41 Deg centigrade (kW)	
6	Power Supply	
7	Overall Dimension (w x d x h in mm)	
8	net weight (kg)	
9	Type of Refrigerant	
10	Pre charged refrigerant Qty (kg)	
11	Type of Compressor	
12	Make & model number of individual compressor	
13	Compressor quantity	
14	Input Power of Compressor motor (kw)	
15	Type of Condenser coil	
16	Type of Condenser Fan	
17	Type of Condenser Fan- Motor	
18	Total Number of Fans for specified capacity ODU	
19	Power input of individual Cond Fan - Motor (kw)	

b. Indoor Unit Technical Data sheet

Sl No	Details of Technical Requirement	
1	Make	
2	Model	
3	Type of VRF Indoor	
4	Nominal Cooling Capacity (TR)	

5	Input Power (KW)	
6	Net weight (kg)	
7	Sound pressure level (db)	
8	Air Flow (CFM)	
9	External Static Pressure (Pa)	
10	Other points mentioned in the specification of AHU	

COMPREHENSIVE ANNUAL MAINTENANCE SERVICE CONTRACT.

TERMS & CONDITIONS FOR COMPREHENSIVE ANNUAL MAINTENANCE CONTRACTS

1. CHECK AND SERVICE UNITS THOROUGHLY ONCE IN EVERY THREE MONTHS.

- A) Checking the pressures of both suction and discharge of the compressors
- B) Inspection for leaks in the refrigeration and drainage system.
- C) Checking performance of all sensors/ controls and adjusts, if necessary
- D) Cleaning Air Filters
- E) Cleaning of Condenser with Air Blower/ Compressed Air/ water.
- F) Cleaning of Evaporator Coil
- G) Checking of Grilles, Diffusers and Dampers for proper Air flow
- H) Cleaning of Condensate Drain

2. Attend to any Breakdown Calls free of charge during normal working hours.

3. SCOPE OF RISK PROTECTION CONTRACT:

- The contract includes –
 1. Routine inspection as specified above
 2. Attend to all Breakdown calls within normal working hours (24hrs).
 3. Repair/ Undertake preventive maintenance work
 4. Supply of parts required for repairs & preventive maintenance including Refrigerant & Oil
 5. This contract includes replacement of all equipment like Compressors, Condenser Coils, Cooling coils, Blower Motor, Air Filter, Electrical Controls etc free of charge.

Unless otherwise specified the following are essential for smooth operation of the plants:

4. Electricity - 415V \pm 10% 3 phase, 4 wire.
5. This contract is not transferable and we reserve the right to terminate it in cases of change in the organization.



LIST OF APPROVED VENDORS

Sl No	Item	Manufacturer
1.	AHU	Systemair/ Flaktwood/ Citizen/ Trane
2.	Condensing Unit	Bluestar/ Voltas/ Daikin/ Carrier/ Hitachi
3.	Split Units	Daikin/ Hitachi/ Carrier/ Toshiba/Mitsubishi Electric/ Bluestar/ Voltas/ O General
4.	Control Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
5.	Power Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
6.	Cable tray	Legrand/OBO/MK-Honeywell
7.	CU Pipe	Rajco/ Nippon/ Mandev
8.	GSS Sheet	Tata/ Jindal/ Sail
9.	Air distribution product	Caryaire/ Dynacraft / Systemair/ Air master
10.	Thermal insulation	Armaflex/ K-flex/ Armacell
11.	VFD	Danfoss/ ABB
12.	Electrical panel	EAP/ System Syndicate/Power and Control/ RNG



Note: For items not covered in the above list or in case of non-availability of preferred make of any item listed above, the make / brand to be used in the work, should have prior approval from the Engineer-In-Charge.

ENVELOPE 35. BOQ WITH SCHEDULE OF RATES

Name of the work: SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF AIR CONDITIONING WORK FOR PROPOSED LABORATORY AND SEATING AREA AT 2ND FLOOR, CRR BUILDING, IIT KHARAGPUR

SR NO.	DESCRIPTION	UNIT	QTY.	UNIT RATE	TOTAL AMOUNT
1	DX type Air Handling Unit with Canopy				
1.1	Supply installation testing and commissioning of double skin air handling unit with mixing plenum, Filter, Coil, expansion valve, capillary and Fan sections of 43mm panel thick duly sandwiched with PU Fand with thermal bridging having outer skin made out of 0.8mm GI preplasticised and inner skin of 0.8mm prepainted complete with backward curved centrifugal fan having efficiency more than 60% , coil section with 6RD copper coil having fins as per spec, with washable prefilter section with prefilters having efficiency of 90% down to 10 microns. The drive unit comprising of TEFC Class F motor shall be installed on a common base and isolated from the bottom casing through spring mounts. AHU shall be as per the detailed spec. Price shall be inclusive of Required Seamless heavy gauge Copper piping with nitrile rubber insulation, 1st charge Refrigerant, electrical panel, cable, cable tray if required, communication cable etc with termination. Unit has to be supplied with Canopy				
	22.0 TR and Air flow: 10000CFM	No.	1		
1.2	Supply, installation & testing of Condensing unit comprising of Multiple hermetic/semi-hermatic type scroll compressors, condenser coil, fan etc as per the spec.				
	Capacity: 11.0 TR each	Nos.	2		
2.0	Supply and erection of GSS ducting with flexible connection with insulated flexible duct for grilles as given in specification.				
	24 G	Sqm	220		
	22 G	Sqm	100		
3.a	Supply, installation & testing of Thermal insulation of supply/return air duct (inside the room) with 13mm thick Al foil faced nitrile rubber (Class: O) and joint sealed with Al tape as per specification.	Sqm	220		
3.b	Supply, installation & testing of Thermal insulation of supply/ return air duct (Exposed area) with 50mm thick 24kg/cum density EPS finished with 12mm thick sand cement plaster.	Sqm	100		
3.c	Supply, installation & testing of Acoustic insulation for Supply air duct using Armasound with 10 mm thick class 1 rating Open cell nitrile rubber with density of 140 - 180 kg / m ³ .	Sqm	30		
4.a	Aluminium Powder coated Grille for supply/return air with al collar damper.	Sqm	10		
4.b	Fresh air arrangement with GI vcd, bird screen & cowl.	Nos	RO		
5.0	Supply and installation of Fusible link type Fire Damper of atleast 90 minutes fire rating made out of 18g x 400mm for Supply/ return air wall opening .	Sqm	2		
6.0	Duct Dampers at IDU Opening	Sqm	2		
7.0	DRAIN PIPING				

SR NO.	DESCRIPTION	UNIT	QTY.	UNIT RATE	TOTAL AMOUNT
	Supply, installation, testing & commissioning of in position the following pipes cut to required lengths and necessary fitting with 6 mm thk.Nitrile Rubber Insulation having weather protective coating.				
7.1	40 mm dia. CPVC pipe.	MTR	15		
7.2	32 mm dia. CPVC pipe.	MTR	6		
8.0	Supply, Installation, Testing & Commissioning of AHU panels for AHU blower DOL Starter.Price shall be inclusive of electrical panel, if required, communication cable etc with termination etc as per requirement.	No	1		
9.0	Supply and installation of Copper Armored XLPE/PVC multi-stranded Cable 1.1KV Rating Size –3C X 4 Sq.MM	Rmt	30		
10.0	Supply, Installation, Testing & Commissioning of cable tray- 150mm wide	Rmt	30		
	SUB TOTAL				
GST@18%					
Total with GST					

