TENDERDOCUMENT

TENDER No: NERO/CON/735/342 dated 26.12.2018

FOR

Tender for Manufacture, Supply, Inspection, Erection, Testing and Commissioning of HVAC Work In Nanotechnology Department Buildings For The Project “Extension Of Academic Complex Phase (V): At IIT-Guwahati Campus, Guwahati”

VOLUME–II

NOTICE INVITING TENDER
ADDITIONAL CONDITIONS OF CONTRACT
TECHNICAL SPECIFICATIONS
DRAWINGS
Tender No: NERO/CON/735/342  
Date: 26.12.2018

NOTICE INVITING e-TENDER (NIT)


Engineering Projects (India) Ltd. invites the online open e-Tenders sealed item rate tender in two bid system through e tendering from the eligible contractors/firms who fulfill the eligibility criteria as per the brief particulars of scope for the Manufacture, Supply, Inspection, Erection, Testing and Commissioning of HVAC Work in Nanotechnology Department Buildings for The Project “Extension Of Academic Complex Phase (V): AT IIT-GUWAHATI CAMPUS, GUWAHATI” in single stage Two Envelope system (Technical bid & Price bid) for the following works:

<table>
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<tr>
<th>Sl. No.</th>
<th>NAME OF WORK</th>
<th>ESTIMATED COST</th>
<th>EARNEST MONEY DEPOSIT (EMD)</th>
<th>COMPLETION PERIOD</th>
<th>TENDER FEES (Rs.)</th>
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<tr>
<td>1</td>
<td>Manufacture, Supply, Inspection, Erection, Testing and Commissioning of HVAC Work in Nanotechnology Department Buildings for The Project “Extension of Academic Complex Phase (V): AT IIT-GUWAHATI CAMPUS, GUWAHATI.”</td>
<td>Rs. 1,90,00,00,000.00 (Rupees One Crores Ninety lakhs only)</td>
<td>Rs. 1,90,000.00 (Rupees One Lakhs Ninety Thousand only)</td>
<td>06 Months</td>
<td>5,900.00 (Rupees Eleven Thousand Eight Hundred only) (GST @ 18% included)</td>
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</table>

The brief scope of work in this tender shall include providing all labour, materials, tools and plant, transportation to site, storage and safe custody of the materials, in manufacture, supply, inspection, erection, testing and commissioning of HVAC WORK in Nano Technology Department Building For The Project “EXTENSION OF ACADEMIC COMPLEX PHASE (V): AT IIT-GUWAHATI CAMPUS, GUWAHATI” all complete except those which are specifically mentioned to be excluded elsewhere in tender documents in the buildings mentioned above. Apart from above, any other services not covered above but required as per direction of EPI are deemed to be included in the scope of work. The work is to be carried out on item rate basis as per bill of quantities and tender conditions. The detailed scope of work is given in tender document.
Time schedule of Tender activities:
(i) Start of Date & Time of availability of documents: From 08:00 PM 26.12.2018
(ii) Last Date & Time for Downloading of tender documents: 16.01.2019 up to 11:00 AM
(iii) Last Date & Time of online submission of Tenders: on or before 16.01.2019 up to 12:00 Noon.
(iv) Date & Time of online opening of tenders (Techno-Commercial Bid): 16.01.2019 at 04:00 PM.
(v) Pre-bid meeting at 4th Floor, Hindustan Tower Block-A, Jawahar Nagar, N.H.37, Guwahati-781022 Assam on 10.01.2019 at 4.00 PM.
(vi) Date & Time of submission of documents in physical form: 16.01.2019 (upto 12:30 PM)

The tenderers shall submit his query for the pre-bid meeting on or before 10.01.2019 by 12.00 hours to neroguwahati@gmail.com or by post to the address given at sl. no 14 below.

Contractors who fulfill the following requirements are eligible to participate in this tender. The joint ventures/Consortium are not accepted.

a) The bidder must have experience of having satisfactorily completed following “similar works” during the last 7(seven) years ending last day of month previous to the one in which applications are invited.

Three similar works each costing minimum 40% of the estimated cost put to tender
OR
Two similar works each costing minimum 50% of the estimated cost put to tender
OR
One similar work costing minimum 80% of the estimated cost put to tender

i. The “similar works” shall mean supply, installation, testing & commissioning of variable refrigerant volume/flow system of any of makes Daikin/ Mitsubishi Electric/ LG/Samsung/ Toshiba/Hitachi.

ii. The cost of free issue materials shall not be included in the completion cost of works.

iii. For evaluation purpose, the completion cost of works mentioned in the completion certificate shall be enhanced by 7% per annum till the end of month prior to date of NIT.

iv. The experience certificates issued by Government Organizations/Semi Government Organizations/State Government / Public Works Department / Central Government/Public Sector Undertakings/ Autonomous Bodies/Municipal Bodies/Public Limited
Companies listed on BSE/NSE shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company can be considered only if they are supported by TDS certificates in support of value of work done by the tenderer. TDS certificate for full contract value as mentioned in the work order must match failing which the same shall not be considered.

v. The bidder should have locally established after sell service provider.

b) Should have had average annual financial turnover of at least 30% of the estimated cost put to tender during the immediate last three consecutive financial years ending on 31.03.2017 duly supported by annual financial report (i.e. audited copies of balance sheet and profit and loss statement) or certified by Chartered Accountant along with Income Tax return for last three assessment years (i.e. 2017-18, 2016-17 and 2015-16). Turnover means income from construction works only.

c) Should not have incurred any loss in more than two years during the immediate last five consecutive financial years, ending 31.03.2017, Copies of balance sheet/ Certificate from Chartered Accountant duly self attested by the tenderer shall be submitted.

d) Should have a Solvency of 40% of the estimated cost issued by his bankers in the name of the bidder. The Solvency Certificate should not have been issued earlier than one year of last date of submission of the tender.

e) Should have valid Permanent Account Number of Income Tax and GST registration certificate.

f) Should have valid PF Registration number. In case the bidder does not have this registration number, he shall remain bound to obtain them within one month from the date of LOI or before release of 1st R/A bill whichever is earlier.

g) Bid Capacity: The bidding capacity of the tenderer should be equal to or more than the estimated cost of the work put to Tender. 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 construction works executed in any one year during the last five years taking into account the Completed as well as works in progress ending last day of the month previous to the one in which applications invited.

- \(N\) = Number of years prescribed for completion of work for which bids have been invited.

- \(B\) = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. The Tenderer is requested to furnish the existing commitments of works under execution along with stipulated period for completion of remaining for each of the work should be furnished in an affidavit on non-judicial stamp paper of value of Rs. 100/- duly certified that the particulars furnished are correct as per the Performa in Annexure –A.

h) Bidders have to submit confirmation letter whether they are registered under MSME Act or not and if yes, then relevant copies of the registration letter (Registered under single point registration scheme of NSIC, Govt. of India, Ministry of MSME, New Delhi vide Gazette Notification dated 26.03.2012 along with the form of Memorandum-2 with the concerned DIC) to be enclosed in Technical Bid and a request letter for exemption from submission of Tender fee and EMD.

i) Site visit for the subject tender is mandatory. The bidders shall visit the site to Study/assess the tendered work and also
acquaint themselves of the prevailing local conditions before submitting their bid. Bidder has to enclose a certificate counter signed by EPI official or furnish undertaking for having visited the site.

j) Even though an applicant may satisfy the eligibility criteria, EPI reserves the right for not issuing the tender document if he has record of poor performance such as abandoning work, not properly completing the work, delay in execution of work, poor quality of work, financial failure / weakness etc.

k) The experience certificates issued by Government Organizations / Semi Government Organizations/ State Government / Public Works Department / Central Government /Public Sector Undertakings/ Autonomous Bodies/Municipal Bodies/Public Limited Companies listed on BSE/NSE shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company and Private Party can be considered only if they are supported by TDS certificates/Turnover Certificate from Chartered Accountant in support of value of work done by the tenderer.

l) Completion certificates from the client shall be in the name of the company who is submitting the tender. The contractor has to produce original documents for their verification as and when demanded by EPI. The tender of any tenderer shall be rejected if on detailed scrutiny; documents submitted along with the tender are found to be unsatisfactory / forged. The decision of EPI in this regard shall be final and the binding on the tenderer.

m) Relevant experience certificates and other documents as mentioned above fulfilling the qualifying criteria duly self-attested by the tenderer shall be enclosed in Envelope-1. Completion Certificates from clients shall be in the name of the Company who is submitting the tender. The bidder has to produce original documents for verification at the time of opening of tender or as and when demanded. The Tender of any tenderer shall be rejected if on detailed scrutiny, documents submitted along with the tender are found to be unsatisfactory. The decision of EPI in this regard shall be final and binding on the tenderer.

n) The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;

   a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

   b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their ongoing / past projects.

   c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

   d) If the tenderers attempt to influence any member of the selection committee.

   e)
The credentials of the Bidders shall be verified and inspection of the works, if required, to be carried out by EPI. If not found satisfactory, their bid will be considered non-responsive.

2.0 Tender documents comprising of the following are available on the website of EPI: www.epi.gov.in, CPP-Portal: www.eprocure.gov.in and as well as on TCIL portal http://www.tcil-india-electronic-tender.com.

Volume I: Instructions to Tenderers, General Conditions of Contract (ITT&GCC) of EPI, Addendum to Instructions to Tenderers & Special instructions to Bidders for e-Tendering

Volume II: a) Notice inviting Tender
   b) Additional Conditions of Contract
   c) Technical Specification (Electrical)
   d) Tender Drawings (as mentioned in the list)

Volume III: Price bid/bill of quantity

3.0 In order to participate, the bidder should have Digital Signature Certificate (DSC) from one of the authorized Certifying Authorities.

4.0 Interested bidders have to necessarily register themselves on the portal https://www.tcil-india-electronic-tender.com through M/s Telecommunications Consultants India Limited, New Delhi to participate in the bidding under this invitation for bids. It shall be the sole responsibility of the interested bidders to get them registered at the aforesaid portal for which they are required to contact M/s Telecommunications Consultants India Limited, New Delhi at following address to complete the registration formalities:
   M/s Telecommunications Consultants India Limited,
   6th Floor, TCIL Bhawan, Greater Kailash – 1, New Delhi – 110 048
   Contact No.: 011-26241790, 98683 93717/75/92
   Email-ID: ets_support@tcil-india.com

They may obtain further information regarding this tender from GM (Contracts) at the address given at Clause No.14.0 below from 10:00 hours to 17:00 hours on all working days till the last date of online submission of Bidding Documents.

For proper uploading of the bids on the portal namely https://www.tcil-india-electronic-tender.com (hereinafter referred to as the “portal”), it shall be the sole responsibility of the bidders to apprise themselves adequately regarding all the relevant procedures and provisions as detailed at the portal as well as by contacting M/s Telecommunications Consultants India Limited, New Delhi directly, as and when required, for which contact details are mentioned above. The EPI in no case shall be responsible for any issues related to timely or properly uploading/submission of the bid in accordance with the relevant provisions of Section: Instruction to Bidders of the Bidding Documents.
5.0 Bidders can download the bid document from the portal without paying document fees in advance, any time from 18:00 Hrs on 26.12.2018 however interested bidders have to pay tender fees for participating in the tendering and submitting the bid. For this purpose the interested bidders shall be required to pay Rs. 5,900.00 (Rupees Five Thousand Nine Hundred only) (GST @ 18% included) the GSTIN of EPI for Assam is 18AAACE0061C1ZC as non-refundable document fees in the form of Demand Draft in favour of “Engineering Projects (India) Ltd.” payable at Guwahati. The fees to be paid to TCIL are separate.

6.0 E-Bids must be submitted/uploaded along with scanned copies of relevant documents mentioned at Clause no.2 of Addendum to Instruction to tenderers under Single Stage Two Envelope Bidding Procedure on the TCIL portal on or before last date& time of online bid submission. Late bids will not be accepted. Under the above procedure, only first envelope(Technical Part) shall be opened in the presence of the bidders” representatives who choose to attend in person at the address given below on scheduled date & time of bid opening or may be viewed by the bidders by logging in to the portal as per features available to them. Second envelope i.e. Price part shall be opened of technically qualified bidders only.

The bid must be accompanied by a Earnest Money Deposit (EMD) of Rs. 1,90,000.00 (Rupees One Lakhs Ninety Thousand only) This can be either in the form of Crossed Demand Draft or Pay Order (in CTS form) of any Nationalized Bank/Scheduled Bank for the full amount of EMD payable favouring “Engineering Projects (India) Ltd.”, payable at Guwahati. The EMD shall be valid for minimum period of 150 days (one hundred fifty days) from the last day of submission of tender. Tenders submitted without EMD or inadequate amount of EMD shall be rejected. The bid shall be valid for 90 days from date of opening of Price Bid.

Tender fee, EMD (In original), Power of Attorney, NSIC/MSME certificate as per Clause No.1 (h) if bidder is claiming EMD/Tender fee exemption and Pass Phrase (Both for technical and financial bid in separate envelope) to decrypt the bid must be submitted in physical form at the address given at Clause No. 14.0 below on or before Last date and time of online bid submission. If the above documents are not received in time then their offer shall not be considered and EPI shall not be responsible for any postal delay in respect of submission of hard copy part of the bids.

7.0 The Terms & Conditions contained in the NIT and tender document shall be applicable.

8.0 The tenderers should note that the credentials such as value and volume of works completed, as submitted by the tenderers along with their offers shall be forwarded by EPI to Client for his opinion. The offer of tenderers against whom client does not give satisfactory remarks shall be rejected by EPI.

9.0 The corrigendum or addendum, extension, cancellation of this NIT, if any, shall be hosted on the EPI’s website/CPP portal as well as on TCIL portal http://www.tcil-india-electronic-tender.com the bidders are required to check these websites regularly for this purpose, to take into account before uploading/submission of tender. All Corrigendum and addendum are to be uploaded duly signed & stamped with tender documents as bid Annexure.

10.0 The intending tenderers must not have been in litigation with EPI for last three years or must not be in litigation with EPI at present. In case the participating tenderer(s) are found to have suppressed information in this respect the EMD submitted by him (they) shall
be forfeited by EPI and his (their) tender shall be rejected. In case such suppression is detected after acceptance of his (their) tender i.e. on award of the works the order/LOI shall be withdrawn and his securities forfeited.

11.0 The Price Bid of those bidders who are found to be prima-facie techno-commercially acceptable based on the documents submitted at the time of bid submission and also against fulfillment of conditions at sl. no. 10 above shall be opened with prior intimation to them. **Hence the intending bidders must furnish their e-mail id and contact phone number along with the techno-commercial part.** However, it is made clear that the offer of the bidders shall be accepted subject to the confirmation of authenticity of the PQ documents/ EMD /Tender fee from the concerned department/ bank. In case the PQ documents such as work experience certificate, bank solvency certificate etc submitted by a bidder is found to be fake the EMD submitted by him shall be forfeited by EPI without making any reference to him. Further such a tenderer shall be at a risk of losing his right to participate in any tender called by EPI for a minimum period of one year.

12.0 EPI reserves the right to accept any tender or reject any or all tenders or split the work of tender or annul this tendering process without assigning any reason and liability whatsoever and to re-invite tender at its sole discretion.

13.0 In case of tie-tender, where two firms are bidding lowest, EPI reserves the right to split the work among these bidders and / or EPI will reserve the right to award the tender to any one of such bidder.

14.0 All correspondence with regard to the above shall be to the following address (By Post/In Person)
   General Manager (Contract)
   Engineering Projects (India) Ltd.
   North Eastern Regional Office
   4th Floor, Hindustan Tower,
   Jawahar Nagar, National Highway No.37,
   Guwahati (Assam) -781022 (Tel No. 0361-2314681, Fax No.0361-2223617)

15.0 For Site related Queries / Site Visit:
   Shri K Kalita, Manager – Gr. I
   Engineering Projects (India) Ltd.
   IITG Campus, Guwahati.
   Phone No: +91-9435561629/8812954148
   For more information on EPI, visit our website at: http://www.epi.gov.in
   For more information on the e-tender, visit website of M/s Telecommunications Consultants India Limited, New Delhi at: https://www.tcil-india-electronic.tender.com

**General Manager(Contracts)**  
**Date: 26.12.2018**
**BID CAPACITY**


**NIT No:** NERO/CON/735/342

**ESTIMATED COST PUT TO TENDER:** Rs. 1,90,00,000.00

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

\[
\text{Bidding Capacity} = \left[ A \times N \times \frac{2}{2} \right] - B
\]

Where,

- **A** = Maximum value of construction works executed in any one year during the last five years taking into account the completed as well as works in progress
- **N** = Number of years prescribed for completion of work for which bids have been invited
- **B** = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited (Format enclosed)

**BID CAPACITY CALCULATION BY BIDDER**

**SIGN & STAMP OF BIDDER**
ANNEXURE-A

AFFIDAVIT

(To be typed on Rs. 100/- non-judicial stamp paper)

I/We ..................................................aged ..............years son of ...............................................do hereby solemnly affirm and declare as follows for and on behalf of the Firm:

LIST OF EXISTING COMMITMENT AND ONGOING WORKS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Works</th>
<th>Client Name &amp; Address</th>
<th>Work Order Value (in Rs)</th>
<th>Work Executed till Date (Rs)</th>
<th>Balance Amount of work to be completed (Rs)</th>
<th>Balance period to complete the works (Total months)</th>
<th>Work to be completed in 06 months (Rs)</th>
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Balance Commitments during 06 months as per NIT Rs.

It is certified that the above particulars furnished are true and correct. If any information given is found to be concealed at a later date, the Contract will be terminated forthwith without prejudice to the rights thereon consequent on termination and the bidder will be blacklisted. I/We agree for debarring tendering for one year if any facts are suppressed.

SIGN AND STAMP OF BIDDER
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract (GCC) of EPI and other conditions of the tender documents. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of GCC and other conditions of the tender documents, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 Engineering Projects (India) Limited has entered into an agreement for execution of the work for “Extension of Academic Complex Phase-V at IITG Campus”. The tender shall include (but not limited to) providing labour, tools and plants, machineries, detailed engineering, transport and all other components including all materials (except those which are specifically excluded from scope/present tender as spelt out elsewhere in the tender documents) required for completion of construction work in the buildings as mentioned in the NIT.

3.0 The IIT Guwahati Campus is located on the North Bank of the river Brahmaputra. This is accessible by road via NH 31 as well as via North Guwahati-Hajo Road from the junction point of North approach of Saraighat Bridge and Guwahati Hajo by-lane.

4.0 The word “Contractor” appearing anywhere in the GCC and the other tender documents shall mean the ‘sub-contractor’ i.e. the successful tenderer on whom the work under the present tender is awarded by EPI.

5.0 Clause no 3.0 of GCC shall stand amended as below:
   The items of work given in the tender documents are for general guidance of the intending tenderers and the works shall be carried out by the successful tenderer i.e. the sub-contractor on item rate basis in conformity with the detailed drawing, technical specifications, additional conditions of the tender documents (including any addition/modification/ alteration/deletion made from time to time therein found essential for completion of works). The work shall pertain to HVAC.
works for NANOTECHNOLOGY Department Building. The sub-contractor shall be deemed to have satisfied himself before tendering as to the sufficiency and correctness of his tender for the works and of the rates and prices quoted in the brief specifications, drawings, scope of work and payment (billing) schedule, which rates and prices shall, except as otherwise provided, cover all obligations under the contract and all matters and things found necessary for proper completion and maintenance of the works. It shall be responsibility of the sub-contractor to incorporate the changes that may be in the scope of work envisaged at the time of tendering and as actually required to be executed. The sub-contractor has quoted his rates after clearly studying the scope of work given in Tender Documents and getting fully satisfied with the various items and technical intricacies involved in the work under his scope of work as envisaged in the tender. EPI shall not entertain any claim of the contractor on account of error or omission by him in this respect except what is admitted by the client.

6.0 No mobilisation advance shall be paid and hence clause no. 8 shall stand deleted.

7.0 Safety Code:
   General
   Contractor shall adhere of safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Owner’s safety rules as set forth herein. Prior to start of construction, Contractor will be furnished of Owner’s —Safety Code— for information and guidance, if it has been prepared.
   First Aid and Industrial Injuries
   (1) Contractor shall maintain first aid facilities for his employee and labours.
   (2) Contractor shall make out side agreements for ambulance service and for the treatment of industrial injuries. Names of those providing these services shall be furnished to the Owner prior to start of construction and their telephone numbers shall be prominently posted in Contractor’s field office.
   (3) All critical industrial injuries shall be reported promptly to the Owner, and a copy of Contractor’s report covering each personal injury requiring the attention of a physician shall be furnished to the Owner.
General Rules
Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators of the no smoking rules shall be discharged immediately.

Contractors Barricades
(1) Sub-contractor shall erect and maintain barricades required in connection with his operation to guard or protect.
(a) Excavations.
(b) Hoisting areas.
(c) Areas adjudged hazardous Contractor’s or Owner’s inspectors.
(d) Owner's existing property subject to damage by Contractor’s operations.
(e) Rail road unloading spots.
(2) Sub-contractor’s employees and workmen shall become acquainted with owner’s barricading practices and shall respect the provisions thereof.
(3) Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights.

Scaffolding
(i) Suitable scaffolding should be provide for workmen for all works that safety be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical)
(ii) Scaffolding or staging than 4 meters above the ground or floor, swing suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise rewarded at least 3 ft. High above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
(iii) Every opening on the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 metre.
(iv) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform of the gangway or the stairway is more than 4 metres above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (ii) above.

(v) Safe means of access shall be provided to all working platforms and other working places, every ladder should be securely fixed. No portable single ladder shall be over 9 metres in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including 3metres in length. For longer ladder this width should be increased at least 5 mm for each additional foot of length. Uniform steps spacing shall not exceed 30 cms. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site of work shall be so stacked or placed to cause danger or inconvenience to any person or public. The Contractor shall also provide all necessary fencing and light to protect the workers and staff from accidents, and shall be bound to bear the expenses of defence of every suit, action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

Excavation and Trenching

All trenches 1.2 metres or more in depth, shall at all times be supplied with at least one ladder for each 50 metres length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1 metre above the surface of the ground. The sides of the trenches which are 1.5 metres in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 metres of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
Demolition

(i) Before any demolition work is commenced and also during the progress of the work.

(a) All road and open areas adjacent to the work site shall either be closed or suitably protected

(b) No electric cable or apparatus which is liable to be a source of danger shall remain electrically charged.

(c) All practical precautions shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

(ii) All necessary personal safety equipment as considered adequate by the Engineer-in-charge, should be kept available for the use of the persons employed on the site and maintained in condition suitable for immediate use, and the sub-contractor shall take adequate steps to ensure proper use of equipment by those concerned.

(a) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective gloves.

(b) Those engaged in white washing and mixing or stacking of cement bags or any materials which are injurious to the eyes shall be provided with protective goggles.

(c) Those engaged in welding and cutting works shall be provided with protective face and eye shields, hand gloves etc.

(d) Stone breakers shall be provided with protective goggles and protective clothing, and seated sufficiently safe intervals.

(e) When workers are employed in sewers and manholes, which are in use, the sub-contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to gate in to the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or board to prevent accident to the public

(f) The sub-contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 years are employed on the work of lead painting, the following precautions should be taken,

(1) No paint containing lead or lead product shall be used except in the form of
paste or ready-made paint.

(2) Suitable face masks should be supplied for use by the workers when Paints are applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

(3) Overalls shall be supplied by the sub-contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash them during and on cessation of work.

(iii) When the work is done near any place where there is a risk of drowning, all necessary safety equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

(iv) Use of hoisting machines and tackles including their attachments, anchorage and supports shall conform to the following standards or conditions:

(a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect and shall be kept in good working order.

(b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.

c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 12 years should be in charge of any hoisting machine including any scaffolding, which or give signals to the operator.

(d) In case of every hoisting machine and of every chain ring hook, shackle, swivel, and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gears referred to above shall be plainly marked with the safe working load of the conditions under which it is applicable which shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

(e) In case of departmental machine, the safe working load shall be notified by the Engineer-in-charge. As regards his own machineries, the sub-contractor shall notify the safe working load of the machineries to the Engineer-in-charge whenever he brings any machinery to site of work and get it verified by the
Engineers concerned.

(v) Motors, gearing transmission, electric wiring and other dangerous part of hoisting appliances should be provided with such means as to reduce to the minimum the accidental descent of the load, adequate precautions should be taken to reduce to the minimum the risk of any part or any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves, and boots as may be necessary should be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

(vi) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

(vii) These safety provisions should be brought to the notice of all concerned by the displaying on a notice board at a prominent place at the work-spot. The person responsible for compliance of the safety code shall be named therein by the sub-contractor.

(viii) To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by the Welfare Officer, Engineer-in-Charge or safety Engineer of the administration or their representatives.

(ix) Notwithstanding the above clauses there is nothing in these to exempt the contractor from the operations of any other Act or rules in force in the Republic of India. The works throughout including any temporary works shall be carried out in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpaths at the site or in the vicinity thereto or any exiting works whether the property of the Administration or of a third party. In addition to the above, the sub-contractor shall abide by the safety code provision as per C.P.W.D. Safety Code and Indian standard Safety Code framed from time to time.

8.0 The clause no. 10.0 of GCC shall stand amended as below:
An amount @5% (Five percent) of the gross value of the running bill shall be deducted from each running bill by way of retention money. In case the EMD has been deposited by the sub-contractor in the form of demand draft, the said amount of EMD shall be adjusted first towards the retention money and further recovery of retention money shall commence when the up to date amount of retention money exceeds the amount of EMD deposited in the form of demand draft. The retention money shall become refundable to the sub-contractor at the end of the defects liability period free of any interest provided always that the sub-contractor has rectified all the defects arising during the defect liability period pertaining to his scope of work, EPI did not have to incur any expenditure in setting right the defects, if any, pertaining to the sub-contractor’s scope of work, the sub-contractor has demolished and removed all structures including foundations and withdrawn fully from the worksite and EPI has received the clearance certificate from the concerned Labour Enforcement Officer/RLC pertaining to the labour etc. deployed by him at the worksite or there is nothing on record against him in the local market affecting functions of EPI. In case EPI has been required to make any expenditure on any of these accounts EPI will keep the retention money till the time all these matters are settled in full including recovery of the expenses, if any, made by EPI from the retention money. Further the sub-contractor has to furnish a ‘No Claim’ certificate to EPI in confirmation of his having no claim on getting refunded the retention money to EPI at the time of claiming refund of retention money.

9.0 The following shall stand added to clause no. 11.0 of GCC:

Water: The contractor shall arrange water fit for the purpose of drinking and construction at his own cost.

Power: Owner will supply power at a point near the work site at his discretion from where the contractor will make his own arrangement for distribution. All the works of the contractor shall be done as per Indian Electricity Act and Rules framed there under and approved by the Engineer-in-Charge. The temporary lines will be removed forthwith after the completion of the work or if there is any hindrance caused to the other work due to the alignment of these lines, the contractor will re-route or remove the temporary lines at his own cost. The contractor at his own cost will also provide suitable electric meters, fuses, switches etc. These shall be in the custody and control of the Owner. The cost of power
supply shall be payable to the Owner every month at the prevailing rates from time to time or will be deducted from the running account bills. Owner, however, does not guarantee uninterrupted power supply and this does not relieve the contractor of his responsibility for the timely completion of various works as stipulated, nor any compensation shall be paid to the contractor for any failure or short supplies of Power. The contractor shall therefore make his own arrangement for standby power supply at his own cost.

10.0 Work in monsoon and dewatering
The completion of the work may entail working in monsoon also. The Contractor must maintain minimum labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered such work in monsoon. During monsoon and other period, it shall be the responsibility of the Contractor to keep the construction work site free from water at his own cost.

11.0 Work on Sundays and holidays
For carrying our work on Sundays and holidays, the Contractor will approach the Engineer-in-Charge or his representative at least two days in advance and obtain permission in writing.

12.0 General conditions for construction and erection mark
The working time at the time of work is 48 hours per week. Over time work is permitted in cases of need and the Owner will not compensate the same. Shift working at 2 or 3 shifts per day will become necessary and the sub-contractor should take this aspect in to consideration for formulating his rates for quotation. No extra claims will be entertained by the EPI on this account.

The Sub-Contractor must arrange for the placement of workers in such a way that delayed completion of the work or any part thereof for any reason whatsoever will not effect their proper employment. EPI will not entertain any claim for idle time payment whatsoever.

13.0 Setting out works
The Engineer-in-Charge of Owner shall furnish the Contractor with only the four
corners of the work site and a level bench mark and the Contractor shall set out the works and shall provide efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

The Contractor shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the sub-contractor. The work shall be set out to the satisfaction of the Owner. The approval thereof or joining with the sub-contractor by the Owner in setting out the work shall not relieve the sub-contractor or any of his responsibilities.

Before beginning the works, the sub-contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboo, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Owner. The Centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable a theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge in writing but such approval shall not relieve the sub-contractor of any of his responsibility. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.

Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the sub-contractor.

On completion of works, the sub-contractor must submit the geodetic documents according to which the work was carried out.

14.0 Responsibility for level and alignment

The sub-contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein. Such rectifications shall
be carried out by the Contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-Charge.

It is highly possible that there shall be more than one agency working at the same time at the site. The sub-contractor shall at all times remain bound to co-ordinate with the agencies, deployed by EPI for the above works, including providing free access and making required provisions for them in execution of works pertaining to their portion of works. He shall also remain bound to ensure uninterrupted progress of work by these agencies in a peaceful and smooth manner. He shall also remain bound to make the required changes/additions/alterations in the works done by him to accommodate the items under the scope of work of such other agencies deployed by EPI or the client. The sub-contractor is deemed to have made the estimated allowances in this respect while quoting his rates at the tendering stage.

All the drawings provided at the tendering stage are for general guidance only and the works shall be carried out as per the drawings and instructions issued by the Owner from time-to-time. EPI shall not entertain any claim of the sub-contractor on account of any omission or any error by him on this account.

Further even though EPI shall take all care to attach all the drawings as issued by the client it shall be the responsibility of the sub-contractor to interpret the drawings for completion of the works under this contract. EPI shall not give any design or bill of quantities except what are being provided with the tender documents. EPI shall not entertain any claim of the sub-contractor on account of any omission or any error by him on this account.

The list of minimum tools, plant and machinery to be provided by the sub-contractor within the period mentioned against the respective item is given at Annexure-A.

15.0 The clause no 9.0 of GCC of EPI shall stand amended as under:

“Within 10 (ten) days from the date of issue of letter of Intent or within such extended time as may be granted by EPI in writing, the Contractor shall submit to EPI a Security Deposit cum Performance Bank Guarantee in the form appended, from any Nationalised bank / Scheduled Bank equivalent to 5% (five percent only) of the Contract Value for the due and proper execution of the contract. This bank guarantee shall remain valid up to 90 (ninety) days after
completion of works.

In case the Contractor fails to submit the Security Deposit cum Performance Guarantee of the requisite amount within the stipulated period or extended period, letter of intent will stand withdrawn and EMD of Contractor shall be forfeited.

16.0 The following shall stand added to the clause no 13 and 14 of GCC:

The rates quoted by the tenderer shall be deemed to include all taxes and duties except GST which shall be reimbursed to him subject to raising a tax invoice and filing of return and payment of tax as per the GST law, failing which EPI shall not be able to honour his claims for any payment. The tenderer should note that submission of return and the same should be displayed in GSTN portal which is mandatory.

17.0 Clause no. 76.1 of GCC shall stand amended as below:

17.1 ARBITRATION:

Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part III of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

i) Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the Specifications, Design, Drawing and Instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the Contract, Designs, Drawings, Specifications, Estimates, Instructions, or these conditions or otherwise concerning the works of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitrator appointed by the Chairman & Managing Director (CMD) of Engineering Projects (India) Limited (EPI) or any other person discharging the functions of CMD of EPI. The person approached
for appointment as Arbitrator shall disclose in writing circumstances, in terms of Sub-Section (1) of Section (12) of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 as follows:

a) such as the existence either direct or indirect, of any past or present relationship with or interest in any of the parties or in relation to the subject-matter in dispute, whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to his independence or impartiality; and

b) which are likely to affect his ability to devote sufficient time to the arbitration and in particular his ability to complete the entire arbitration within a period of twelve months.

The Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

ii) if the arbitrator so appointed resigns or is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman & Managing Director aforesaid or in his absence the person discharging the duties of the CMD of EPI may appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

iii) It is a term of the contract that the party invoking the arbitration shall specify the dispute differences or questions to be referred to the Arbitrator under this clause together with the amounts claimed in respect of each dispute.

iv) The Arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceedings.

v) The work under the contract shall continue as directed by the Engineer-In-Charge, during the arbitration proceedings.

vi) Unless otherwise agreed, the venue of arbitration proceedings shall be at the venue given in the 'Memorandum’ to the 'Form of Tender’.

vii) The award of the Arbitrator shall be final, conclusive and binding on both the parties.
viii) Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modifications or re-enactment thereof and the Rules made there under and for the time being in force shall apply to the arbitration proceedings and Arbitrator shall publish his Award accordingly.

17.2 Clause no 76.2 of GCC shall stand amended as under
“In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSE) / Port Trust inter se and also between CPSE and Government Departments / Organizations (excluding disputes concerning Railways, Income Tax, Customs and Excise Departments), such dispute or differences shall be taken up by either party for resolution through AMRCD as mentioned in DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22.05.2018”

18.0 The clause nos. 17.0, 18.0 & 19.0 of GCC of EPI shall stand amended as under:
Insurance charges for insurances to be taken by EPI for the project like Contractor’s All Risk Policy, Erection All Risk Policy including transit and third party liability shall be borne by the sub-contractor in proportion to his contract price. However, the sub-contractor shall take insurance cover at its own cost towards Workman Compensation Act for its own workers and employees engaged by it for the works under the present tender/sub-contract within 10 days of issuance of Letter of Intent by EPI and shall furnish documentary proof of the same to EPI. In case the sub-contractor fails to do so, EPI shall be at liberty to withhold all payments to the sub-contractor till the submission of such documentary evidence or take the required insurance policy under the Workman Compensation Act and recover the cost of the insurance premium(s) paid in this respect by EPI to the insurance company from the sub-contractor’s bill(s). Notwithstanding payment of such insurance premiums and the resulting recovery thereto the sub-contractor shall remain bound to assist EPI in follow up with the insurance company in case of any claim related to the sub-contractor’s scope of work. EPI is not liable to pay any claim of the sub-contractor if it is not
paid by insurance company due to any reasons whatsoever. The insurance company providing such insurance cover must be approved by IRDA.

Employee State Insurance Act

The sub-contractor agrees to and does hereby accept full and exclusive liability for compliance with all obligations imposed by the Employees State Insurance Act, 1984, and the sub-contractor further agrees to defend, indemnify and hold Owner harmless from any liability or penalty which may be imposed by the Central, State or Local authority by reason of any asserted, violation by sub-Contractor of the Employees State Insurance Act, 1948, and also from all claims, suits or proceeding that may be brought against the Owner arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of the sub-contractor, by third parties or by Central or State Government authority or any political sub-division thereof.

The sub-contractor agrees to fill in with the Employee’s State Insurance Corporation, the Declaration Forms, and all forms which may be required in respect of the sub-contractors’ employees, whose aggregate remuneration is such amount as prescribed under the Employees State Insurance Act, 1948 from time to time and who are employed in the work provided for or those covered by ESI from time to time under the Agreement. The sub-contractor shall deduct and secure to deduct the employee’s contribution as per the first schedule of the Employee’s State Insurance Act from wages and affix the Employee’s contribution Cards at wages payment intervals. The sub-contractor shall remit and secure the to remit to the State Bank of India, Employee’s State Insurance Corporation Account, the Employees contribution as required by the Act. The sub-contractor agrees to maintain all cards and records as required under the Act in respect of employees and payments. Any expenses incurred for the contributions, making contributions or maintaining records shall be to the sub-contractor’s account.

The Owner shall retain such sum as may be necessary from the total contract value until the sub-contractor shall furnish satisfactory proof that all contributions as required by the Employees State Insurance Act, 1948, have been paid.

19.0 The following shall stand added to the clause no 20 of GCC:
The sub-contractor shall keep EPI indemnified against all claims, damages, compensation and expenses payable, if any, in consequence of any accident, or injury sustained by any workman or any other person employed by the sub-contractor.

20.0 The following shall stand added to Clause no 21.0 and 23.0 including their sub-clauses of the GCC:
Notwithstanding the fact that EPI may have obtained or may be in the process of obtaining a valid license under the Contract labour (Regulation and Abolition) Act 1970 and Contract Labour Act (R & A) Central Rules 1971 and amended from time to time and registration under Building and other Construction Works (Regulation of Employment and Conditions of Service) Act 1996 and Building and Other Construction Workers’ Welfare Cess Act 1996 from the relevant office of the RLC and continues to have them until the completion of work including the maintenance and defect liability period, the sub-contractor shall at all times remain bound to comply with and observe the provisions of the all laws and regulations pertaining to the deployment of contract labour. He shall also extend all assistance to EPI during inspection of the officials of such law enforcing agencies including the rectification of defects/ observations (if any) made/pointed out during the visit(s) of the officials of the said ALC/RLC under jurisdiction of whom the work site shall be covered.

21.0 The following shall stand added to the clause no 27.0 including its sub-clauses of GCC of EPI:
The sub-contractor, within 10 days of issuance of LOI (Letter of Intent) to him shall depute at least one graduate electrical or mechanical engineer with 10 years of post-qualification experience or two persons having diploma in mechanical engineering with 15 years of post-qualification experience and adequate number of supervisors.

22.0 The clause no 28.3 of the GCC stands modified as under:
The sub-contractor shall bear the cost of construction or maintenance of the facilities as mentioned under this clause proportionate to his value of the
works/sub-contract awarded to him provided, however, that the cost of construction of the office shall not exceed Rs. 20,000/- (Rupees Twenty Thousand only) and amount not exceeding Rs. 2,000/- per month till completion of work for maintenance of facilities i.e. stationary, letter head, visiting card, one post paid mobile connection, internet connection. Further the sub-contractor has to bear the proportionate cost of the Project sign board (type and format given at Annexure-3).

23.0 The following shall stand added to the clause no 31.0 of the GCC:
The sub-contractor shall take a suitable policy in compliance with the Workmen’s Compensation Act 1923 within 10 days of issuance of LOI and keep it valid till completion of works or till the time he is required to keep his workmen at the worksite whichever is later and produce a copy of the receipts of the premium paid by him in this regards as and when asked by EPI.

24.0 No secured advance shall be paid to the sub-contractor and hence clause no. 35.0 of GCC shall stand deleted.

25.0 The following shall be added to the clause no 36.0 of the GCC:
The measurement of the works as certified/recorded by the client for the portion of works executed by the sub-contractor shall be final and binding on the sub-contractor. The contractor shall remain liable to provide all assistance at the time of recording the measurements by the client.

26.0 Payment’s: The clause no 37.0 of the GCC stands modified as under:
Payments as and when received by EPI from the Client for the sub-contractor’s portion of work shall be released to him within seven working days of its receipt by EPI and after making the recoveries towards facilities mentioned at clause 22.0 hereinabove and other recoveries.
All running payments shall be regarded as ‘on account’ payments only and not as payments for work actually done and completed and/or accepted by EPI or Owner and shall not preclude the recovery for bad, unsound work and imperfect or unskilled work to be removed and taken away and reconstructed or re-erected or
to be considered as an admission of the due performance under the agreement or
the accruing of any claim nor shall it conclude, determine or affect in anyway the
powers of EPI under these conditions or any of them as to the final settlement and
adjustments of the accounts or otherwise or in any other way vary/affect the
contract.

Further, subject to entering into a mutually agreeable billing schedule, the sub-
contractor will, in general, be eligible to get running payment as under:
-For equipment and piping: a) 75% of the invoice value of the
 manufacturer/supplier on receipt at site or 75% of the rate of
 the particular item as per bill of quantities or derived basic rate
 of the item after making provisions for overhead and labour
 component in the item rate whichever is lowest.
b) Balance payment shall be released in proportion to the
 payment received from the Owner for the sub-contractor’s
 portion of work.

-For other items: proportionate to the payment received from the Owner for the
 sub-contractor’s portion of work.

The final bill payment to the sub-contractor shall be released only after receipt of
 corresponding payment from client and when the sub-contractor submits all other
 clearances, approvals, certificates etc. as per agreement of EPI with the client for
 the “Works” and as per statutory requirement.

The sub-contractor shall have no claim on EPI in case the payments are delayed
 by the client due to any reason whatsoever.

27.0 The clause no. 43.2 shall stand amended as below:

The sub-contractor shall execute the works so as to complete the works within the
 stipulated completion time and submit a programme showing deployment of resources
 for completion of the works within the said completion time including achievement of the
 milestones as mentioned below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Milestone</th>
<th>Time allowed in days/months (from date of start)</th>
<th>Amount to be withheld in case of non-achievement of milestone</th>
</tr>
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<tbody>
<tr>
<td>a)</td>
<td>25% value of works</td>
<td>30% of completion time</td>
<td>In the event of not achieving the necessary progress Rs 3.0</td>
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</tbody>
</table>
In case entire work is completed within the completion time (i.e. time for completion of work) including any allowed extension thereto, the recoveries made, if any, for not achieving the aforesaid progress milestones at intermediate stages shall be refunded to the contractor free of any interest.

28.0 The following shall be added to clause no 52.6 of GCC:

The field testing laboratory to be established by the sub-contractor at his cost shall be equipped with the minimum number of testing equipment as per annexure-B

29.0 The following provisions shall supersede that of clause no 69 of GCC wherever applicable:

No claim on account of extra / substituted / variation of items etc. pertaining to the sub-contractor’s portion of work save and except what is admitted and paid by Client, shall be entertained or admitted by EPI. Any claim by the sub-contractor, if not paid by the Client, whatsoever be the reason shall not be admitted by EPI. The amount, if at all admitted and paid by the Client for the sub-contractor’s portion of work, shall be paid to him after making a provision of 10% (ten percent) towards EPI’s overhead and administrative charges. The provision of this clause shall equally apply to the decrease in the rate of item by the owner. EPI’s decision in this respect shall be final and binding on the sub-contractor. But under no circumstances sub-contractor shall suspend the work on the non-settlement of rates under this clause.

Further the quantity given in the Price Bid/ Bill of Quantity can vary up to ± 20% of the contract price without any change in the rates.

30.0 Recovery for delay in completion :

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<tbody>
<tr>
<td>b)</td>
<td>50% value of works</td>
<td>60% of completion time</td>
</tr>
<tr>
<td>c)</td>
<td>75% value of works</td>
<td>75% of completion time</td>
</tr>
</tbody>
</table>
In case the project execution is delayed beyond the contractual scheduled completion period due to reason attributable to the sub-contractor, the staff and site office expenses of EPI for extended period shall be paid by him to EPI at the rate of Rs. 10,000/- per month. This shall be in addition to the facilities provided by the sub-contractor to EPI and the other recoveries, if applicable as per clause no 72 (including its sub clauses) of GCC and Penalties etc. if any, levied by Client for the works pertaining to the sub-contractor’s scope of work. The decision of EPI in this regard shall be final & binding on the party.

31.0 Responsibility of materials
The sub-contractor shall be responsible for obtaining all approvals from Client with regard to quality of materials & workmanship and measurements etc. for their portion of work. All such approvals shall be in the name and title of EPI. The sub-contractor shall be responsible for reconciliation of issued material with Client/EPI, if any, and the sub-contractor shall make arrangements for safe up keeping / custody of the material and final reconciliation is also to be done by the sub-contractor. In case there is any shortfall of any issued items during reconciliation, recovery at double the cost of materials prevailing at that time of recovery shall be made from the sub-contractor’s due payment.

32.0 Dealing with Owner etc
The sub-contractor will not deal directly with Client and all the correspondence in matters regarding bills, claims, interpretation of the specifications, conditions and all matters related to the contract with Client, Client’s Consultants, all other agencies including Government and Statutory bodies etc. shall be done through EPI only. The sub-contractor shall prepare and submit expeditiously all bills, claims, details, clarifications, documents, information, etc. as required by EPI/Client for proper execution and successful completion of the “Works”.

33.0 Interpretation
Issues related to interpretation and claims, if any, related to the sub-contractor’s scope of work, arising out of contract between EPI and Client shall be referred with full justification by the sub-contractor to EPI for settlement with Client including
arbitration with Client, if inescapable, and outcome of such a settlement shall be binding on the sub-contractor. EPI at its option may associate the sub-contractor in the above process of settlement for his portion of work. The cost & expenses on arbitration with Client shall be shared by EPI and the sub-contractor in proportion of his offer and EPI’s mark up towards its overheads & profits. In case the award/settlement with the Client is in favour of EPI, ninety percent of the award/settlement amount shall be shared between EPI and sub-contractor in proportion of sub-contractor’s contract price with EPI and EPI’s mark up towards its overheads & profits. The balance ten percent of the award/settlement amount shall be retained by EPI towards its administrative charges. In case the award/settlement is against EPI, the entire damages/counterclaims imposed, if any, shall be borne by the sub-contractor alone and the sub-contractor shall have no claim whatsoever against, EPI in such a settlement. Further, EPI shall have no liability towards any claim of the sub-contractor, which is not paid by the Client.

34.0 No claim for non-approval

In case of non-approval of sub-contractor’s association for the Project by the Client and/or by the corporate office of EPI due to any reasons whatsoever at any stage of the “Works”, the sub-contractor shall have no claim on EPI.

35.0 Inspection and responsibility

The work executed by the sub-contractor shall be subject to audit and quality control checks from Quality Control Division & Technical Audit of EPI, Client, and Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/substandard works as brought out in the report or noticed otherwise at any time during execution, maintenance period etc., the same shall be made good by the sub-contractor without any cost to EPI. In case the sub-contractor fails to rectify the defect/substandard work within the time period stipulated by EPI, EPI shall get it rectified at the risk and cost of the sub-contractor and shall recover the amount from the dues of the sub-contractor.

36.0 Actions for false information

EPI has agreed to associate the sub-contractor on the basis of details regarding his experience profile, financial standing, credentials, fulfilment of statutory obligations, etc. by him to EPI. In case, at a later stage if it is found that the sub-
contractor has submitted incorrect, false details and credentials resulting in apprehensions on the capabilities of the sub-contractor with regard to quality & timely completion of works, financial capabilities etc, EPI can terminate this order solely at its option. In this eventuality the sub-contractor shall be liable for the losses suffered by EPI and further the sub-contractor shall have no claim on EPI, whatsoever.

37.0 Non-applicability of concessions or exemptions

However, if EPI is granted some concession or exempted from certain obligations by Client, by virtue of EPI being a Public Sector Company, the same concessions / exemptions shall not be applicable to the sub-contractor. The decision of EPI in this regard including interpretation of terms & conditions shall be final & binding on the sub-contractor.

(Signature and seal of the Tenderer)
### LIST OF MINIMUM TOOLS, PLANT AND MACHINERY

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Portable Grinder (Electric)</td>
<td>Two nos.</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>2</td>
<td>Portable Welding Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>3</td>
<td>DG Set 5 KVA (Minimum)</td>
<td>One no</td>
<td>15 days</td>
</tr>
<tr>
<td>4</td>
<td>Portable Gas Cutting Sets with hoses and regulator</td>
<td>Two nos.</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>5</td>
<td>Pipe Threading Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>6</td>
<td>Pipe Bending Machine (Hydraulic)</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>7</td>
<td>Portable Drilling Machine suitable for drilling of different sizes</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>8</td>
<td>Power Hacksaw</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>9</td>
<td>Hydraulic Crimping Machine</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>10</td>
<td>Hand Crimping Tools</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>11</td>
<td>Portable Electric Blowers</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>12</td>
<td>Portable Vacuum Cleaners</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>13</td>
<td>Plate/sheet cutting machine, Bending Machine</td>
<td>Two sets.</td>
<td>-do-</td>
</tr>
<tr>
<td>14</td>
<td>Hoisting lift for materials with winch</td>
<td>One set</td>
<td>25 days</td>
</tr>
<tr>
<td>15</td>
<td>D-spanners, Ring spanners, box spanners etc of assorted size</td>
<td>As required</td>
<td>-do-</td>
</tr>
<tr>
<td>16</td>
<td>Cutting, twisting and combination pliers</td>
<td>Three nos.</td>
<td>10 days</td>
</tr>
<tr>
<td>17</td>
<td>Screw drivers-both star headed and plain headed of different sizes</td>
<td>Two sets</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>18</td>
<td>Slide wrench, pipe wrench etc</td>
<td>-do-</td>
<td>-do-</td>
</tr>
</tbody>
</table>
Note:

(a) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this tender.

(b) The quantities and list of equipments indicated are tentative and can be increased/amended as per the requirement of work OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as contract documents.

(c) The sub-contractor will not be allowed to take out equipments from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
# ANNEXURE-B

## LIST OF MINIMUM TESTING EQUIPMENT

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insulation tester 0-500-1000 V hand driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>2</td>
<td>Insulation tester 2500/5000 V motor driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>3</td>
<td>Phase sequence indicator</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>4</td>
<td>Earth megger</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>5</td>
<td>Single phase variac</td>
<td>One set</td>
<td>15 days</td>
</tr>
<tr>
<td>6</td>
<td>3 Phase Variac</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>7</td>
<td>AVO-meter/multimeter</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>8</td>
<td>Portable ammeter, wattmeter, voltmeter</td>
<td>One set</td>
<td>7 days</td>
</tr>
<tr>
<td>9</td>
<td>Hydraulic pressure testing apparatus</td>
<td>One set</td>
<td>30 days</td>
</tr>
<tr>
<td>10</td>
<td>Clip on meters of different ranges</td>
<td>18 nos.</td>
<td>10 days</td>
</tr>
<tr>
<td>11</td>
<td>Tachometer</td>
<td>One set</td>
<td>15 days</td>
</tr>
</tbody>
</table>

**Note:**

a) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this tender.

b) The quantities of equipments indicated are tentative and can be increased as per the requirement of work OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as contract documents.

c) The sub-contractor will not be allowed to take out equipments from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
TECHNICAL SPECIFICATIONS for Extension of ACADEMIC COMPLEX Phase-V at IITG campus (Department of Nano Technology):

A: STANDARD SPECIFICATION OF VARIABLE REFRIGERANT VOLUME / FLOW SYSTEM (OUTDOOR UNIT)

1.0 The specifications under this section covers the supply, installation, testing and commissioning of the VARIABLE REFRIGERANT VOLUME / FLOW SYSTEM conforming to these specifications and in accordance with the Detailed Bill of Quantities given in the tender.

2.1 General

Each VRV / VRF Unit shall be air cooled, split type multi-system air conditioner consisting of outdoor units and number of indoor units, each having capability to cool and heat for the requirements of the individual area to be air-conditioned. The VRV / VRF unit should be capable of connecting minimum ten different type of indoor units to one refrigerant circuit and controlled individually.

Each VRV / VRF unit shall have 4th Generation modular type inverter compressor (With inverter controller) capable of changing the rotating speed to follow variations in cooling loads. Each indoor units having capability to cool or heat for the requirement of the rooms.

Compressor shall be inverter controlled Compressor installed in each outdoor module unit shall be equipped with 4th Generation modular type inverter compressor machines for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

The Outdoor units shall be suitable for mix-match connection of following type.

- Ceiling mounted cassette type (Double flow)
- Ceiling mounted cassette type (Multi flow)
- Ceiling mounted duct type.
- Ceiling suspended type.
- Wall mounted type
- Floor standing type
- Concealed floor standing type.

Please note that the refrigerant piping shall be capable of extending up to 100m with 50m level difference without any oil traps.

Both indoor and outdoor units shall be factory assembled, tested and filled with first charge of refrigerant. These being very hi-tech in construction with lots of factory checks being conducted, hence no sub assembly should be done at site preferably.

3.2 OUTDOOR UNIT

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired tested with all necessary controls tested prior to dispatch conforming to the following specifications.

a) All outdoor units shall consist of minimum two compressors with inverter drive, capable to operate even when one compressor is unserviceable.
b) The outdoor unit shall be modular in design to facilitate installation one after another close to each other. Preference would be given to compact units having smaller footprint.

c) Outdoor units should be rugged of anti-corrosion design and should have strong base plate for easy mounting of unit.

d) The outdoor unit shall comprise of sub-cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping.

e) The condensing unit shall be provided with state-of-the-art microprocessor based control panel.

f) The outdoor unit shall be provided with provided with Aero spiral design fan exhibiting low noise level characteristics complete with aero fitting grille to facilitate spiral discharge of airflow to effect reduction in pressure losses. The fan should be capable to respond to external static pressure of 5mm.

g) Motor shall be speed controlled to ensure a stable operation for varying ambient, by a factory fitted direct acting head pressure activated variable speed drive for at least 15 steps to give precise discharge pressure and minimum power consumption of condenser fan motor.

h) The condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessories necessary with the equipment supplied.

The condensing unit shall be designed to facilitate fail safe operation when connected to multiple indoor units. If possible, the system should work on standard operating parameters like discharge pressures of not more than 300 PSI as the ref. Piping will be moving around within a residential house, otherwise on any misfortune of any leakage it will act like a bullet on higher pressures. If working on higher operating pressures, vendor to comply with all safety codes of high pressure safety & testing as recommended by Japanese (being Japanese design product) and give 2 sets of special tools to handle such equipment at site. All brazing should be done by only qualified trained person who had training on HIGH PRESSURE brazing, special tools & procedures.

23 SCROLL COMPRESSOR

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermetic compressor with scroll plates, suction & discharge service valves. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

The compressor shall be highly efficient digital scroll type or inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement:

a) All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.

b) Oil heater shall be provided in the compressor casing.
c) The inverter compressor shall preferably be efficient & reliable inverter compressor.

14 HEAT EXCHANGER

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

a) The aluminum fins shall be covered by anti-corrosion resin film.

b) The unit should be with heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.

c) The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

4.50 REFRIGERANT CIRCUIT

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end. The equipment must have inbuilt refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

4.60 REFRIGERANT

The VRV / VRF units shall be selected on R-410A refrigerant. The units should be fully factory charged with refrigerant & oil & spare refrigerant & oil must be sent along with the machine for topping up of gas & oil as may be required.

4.70 SAFETY DEVICES

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be integral part of the outdoor unit:
- High pressure switch
- Fan drive overload protection switch
- Fusible plug
- Overload relay including overload protection for inverter driven compressor.

4.80 OIL RECOVERY SYSTEM

Entire system shall be designed and capable of oil recovery to ensure stable operation with long refrigeration piping lengths.

The system should have inbuilt (avoid external) oil balancing circuit to avoid poor lubrication.
STANDARD SPECIFICATION OF INDOOR UNITS

1.0 INDOOR UNITS

This section deals with supply, erection, testing and commissioning of Various Type Of Indoor Units confirming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in Detailed Bill of Quantities.

2.0 GENERAL

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

a) The address of the indoor unit shall be set automatically in case of individual and group control

b) In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be slide away type and neatly inserted.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling or cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

2.2 CEILING MOUNTED CASSETTE TYPE UNIT (MULTI FLOW TYPE)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type. Also Units shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision (if specified) and very low operating sound.

All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts.
3.3 **CEILING MOUNTED DUCTABLE TYPE UNIT**

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement.

3.4 **CEILING SUSPENDED TYPE**

Unit shall be suitable for ceiling suspended arrangement below false ceiling. The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

3.5 **HIGH WALL MOUNTED UNITS**

The units shall be wall-mounted type. The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Unit shall have an attractive external casing for supply and return air.

3.6 **FLOOR STANDING TYPE**

Unit shall be suitable for floor standing arrangement. The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

3.7 **AHU TYPE**

- **DOUBLE SKINNED CASING**

The casing shall be self supporting type, factory fabricated & assembled made of extruded anodised aluminum hollow sections to make a rigid frame structure. The frame shall be assembled using pressure die cast aluminum joints. The self supporting unit shall consist of sandwiched panel made out of 0.6mm thick pre-plasticide / pre-coated GI sheet outside & 0.6mm GI sheet inside duly factory fabricated & insulated with 23 mm thick injected PU foam insulation of 36 kg/m³ density in between as specified in Detailed Bill of Quantities. The insulated panels shall be bolted to main frame with neoprene rubber gaskets held captive in the framed extrusion to make it leak proof. Suitable air tight access doors / panels with pressure die cast aluminum hinges & nylon handles and locks shall be provided for access to various sections for maintenance. The Entire housing shall be mounted on Extruded Aluminum channel frame work having pressure die cast aluminum jointers or the frame work shall be joined together with corner plates Condensate. Drain Pan shall be constructed of 18 gauge polished stainless steel sheet with all corners welded with uniform slope from all sides leading to drain pan ensuring no stagnation of condensate water. Drain Pan shall be sandwich type insulated with 10 mm thick nitrile foam.

- **MOTOR & DRIVE FOR AIR HANDLING UNITS**

The fan motors shall be 415 ± 10% volts, 50 ± 5 % HZ, 3 phase TEFC SQ. Cage induction motor. The motor shall be specially designed for quiet operation & motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt drive arrangement. Belts shall be of the resistant type only.

- **FAN OF AIRHANDLING UNITS**

The casing shall have heavy gauge GI construction forward curved DIDW imported fan statically & dynamically balanced mounted on EN8 solid shaft or C 40 carbon steel. The supply air DIDW fan shall be forward curved. The fan impeller shall be supported to housing with angle iron frame & pillow block heavy duty ball bearing. The fan shall be selected for a fan outlet velocity below 11 meter / sec. The fan housing with TEFC Sq. Cage motor shall be mounted on a common adjustable base frame on vibration isolators in case the impeller diameter is exceeding 450 mm & rubber turret mounts vibration isolators for fan diameter up to 450mm diameter. The fan motor shall be installed inside the housing of air handling unit to keep low noise level. The fan & motor assembly
shall be of aluminum extruded section only. The Fan speed should be selected not more 1000 RPM. The Noise Level not more than 70 db Level.

- **REFRIGERANT COIL**
  The Refrigerant Coil shall be made of aluminum fins and copper tubes of dia.12.5mm or 16mm OD. The minimum no. of fins / cm for cooling coils shall be 4.72. The bonding of aluminum fins with copper should be done hydraulically. The tube thickness shall be 0.51 mm & fin thickness shall be 0.15 mm the cooling coil should be tested for leaks at a hydraulic pressure of at least 10 Kg / sq.cm. for a minimum period of 3 hours at works. The velocity across face should be limited to 152 metre / minute. In case of chilled water coils the design should be such to limit water velocity to maximum of 2.5 m / sec.

- **FILTERS**
  Each unit shall be provided with a factory assembled filter section containing washable synthetic tube air filters having extruded aluminum frame having filtration capacity of 10 micron particle size with an efficiency of 90% efficiency. Filters shall fit so as to prevent by pass. Holding frames shall be provided for installing a number of filters cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels. Face velocity across filters shall not exceed 152 MPM

3.8 **CENTRALIZED TYPE REMOTE CONTROLLER**

A multifunctional compact centralized controller shall be provided with the system.

The controller should be LCD remote controller to act as an advanced air-conditioning management system to give complete control of VRV / VRF air-conditioning Equipment, It should have ease of use for the user and must have a user friendly panely and LCD display.

It shall be able to control up to minimum 64 indoor units with the following functions:-

a) Starting/stopping of Air-conditioners as a zone or group or individual unit.

b) Temperature settling for each indoor unit or zone.

c) Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.

d) Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.

e) **OPTIONAL**-Display of air conditioner operation history.

f) **OPERATIONAL**-Daily management automation through yearly schedule function with possibility of various schedules.

The controller shall have wide screen user friendly LCD display and can be wired by a non polar 2 wire transmission cable to a distance of 1 km. away from indoor unit.

3.8 **COLOUR**

The colour of indoor units should be white or to suit interiors as designed by the architects / clients.

- Reasonable variation from 0.02 to 0.25 TR shall be allowed while considering acceptance of nearest values.
SECTION – HVX 3B

STANDARD SPECIFICATION

2.0 SCOPE OF WORK

The complete scope of work shall cover supply, erection, testing and commissioning of the entire HVAC system as detailed under specification.

2.10 BASIS OF DESIGN

The entire system has been based and designed on climatological data available as given under Basis of Design and Scheme.

2.20 TERMS AND DEFINATIONS

The followings terms have been used in the tender specifications, drawings etc.

ISI

Bureau of Indian Standards.

ASHRAE

American Society of Heating Refrigeration & Air-conditioning Engineers, USA.

ASME

American Society of Mechanical Engineers.

ASA

American Standard Association.

B.S.

British Standards.

CMH

Cubic Meter per Hour.

US GPM

US Gallons per minute.

IGPM

Imperial Gallons per Minute.

RPM

Revolutions per Minute.

BTU/Hr.

British Thermal Unit per Hour.

Kcal/Hr.

Kilo Calories per Hour.

HZ

Hertz.

H.P.

Horse Power

Kg/Cm2 Kilo Gram per Square Centimeter.

SAG

Supply Air Grills.

SAD

Supply Air Diffuser.

SAF

Supply Air Filters.

FD

Fire Damper.

VCD

Volume Control Damper.
2.30 The codes, regulation as detailed below shall be followed in this contract:

3. Testing of refrigeration compressors IS 5111 : 1993
5. Thermostats for use in refrigeration etc. IS 11338 : 1965 (reaffirmed 1991)
7. Steel for general structural purpose IS 2062 : 1992
8. Welding IS : 3589
9. Refrigeration As per ASHRAE / ISI
   Air-conditioning & Refrigeration
   Air-conditioning Institute Standards.
10. Hot Dip Zinc Coated Steel Tubes IS 4736 : 1968
11. Colour code for the identification of pipe lines IS 2379 : 1963
12. Specific requirements for the direct switching of the individual motors. IS 4064 (Part II) 1978
13. PVC insulated (HD) Electric IS : 1554 (Part I)
Cables for working voltage up Including 1100 Volts.

14. HRC Cartridge fuse links upto 650 Volts. IS 2208 : 1976

15. Starter IS 8554 ( Part I) 1979

16. Inspection and testing of installation IS 732 ( Part III) 1979

17. PVC insulated ( heavy duty ) cables for working voltage up to 1.1. KV and up to 11 KV Grade respectively. IS 1554 : 1981 Part I & II


20. Wrought aluminium & aluminium alloy sheet and strip for general engineering purposes. IS : 737

21. Mild steel tubes, tublar and other wrought steel fittings. IS : 1239

22. Contactors for A.C for voltage upto 1100 V. IS 2959 : 1975

23. Low voltage switch gear and control gear assemblies. IS 8623 : 1993 Part I & II

24. Code of practice for selection of starters for AC induction motors IS 3914

25. Specification for cables glands IS 4821


27. Conduits for electrical installations IS 9537 : 1981 Part I to IV


30. Unbounded glass wool for thermal insulation ( 1st. Revision) IS 3690 : 1974
2.40 SAFETY CODES

The following IS codes shall be followed:

Safety code for mechanical refrigeration IS 660
Safety code for air conditioning IS 659
Safety code for scaffolds & ladders IS 3696
Code of practice for fire precaution in Welding & cutting operations IS 3016
Code for safety procedures and practices in electrical works IS 5216
Code of practice for safety and health Requirements in electrical & gas welding And cutting operations IS 3696

2.50 SPACE

All shop drawings shall be prepared by the A.C Contractor after examining the Architectural drawings, site conditions and consultants tentative layout plans.

END OF SECTION – HVX 3B
NOISE AND VIBRATION CONTROLS

1.0 The air conditioning contractor must take all necessary precautions to have minimum noise generation and its transmission. Minimum vibration as permitted by IS relevant code shall be ensured. A few points for guidance only are given below:

2.1 a) Double fire retardant flexible connections shall be provided from air discharge to outlet of air-handler to the duct.

b) Vibration isolation pads of suitable thickness commensurate to loading for isolation of vibration shall be provided under all VRV systems. In consultation with manufacturer for proper selection of vibration isolators.

c) Flexible conduit connections of minimum diameter of 50mm to motors shall be provided. All loops should be large enough to allow connections to remain flexible.

d) All conduit connection where conduits are 60mm or larger shall be made of 1.2 meters minimum length conduit installed in the shape of U and grossly slack to provide maximum vibration isolation.

e) Operating clearance of 40mm shall be kept between the base and the inertia base.

f) All items suspended from false ceiling shall be isolated on separate hangers.

g) In case of ducts, conduits, pipes & tubes the annular space between construction and penetrating element shall be sealed with sand cement plaster.

h) All duct starting from fresh air fan unit shall be provided with acoustic lining. The duct lining shall be 12mm thick fibre glass rigid board with a density of 48 kg/cubic meter.

i) The air-conditioning contractor shall take all other precautions or shall make his own arrangements even if not specified in the tender documents for eliminating high noise levels & shall minimize vibrations in all mechanical equipments without any additional cost.

END OF SECTION – HVX 3C
3D.10 MATERIAL OF INSULATION

The insulation material of the following kind shall be used for cold insulation.

a) RESIN BONDED FIBRE GLASS WOOL

The Thermal conductivity values in W/m.K of fibreglass shall confirm to following:

<table>
<thead>
<tr>
<th>Mean Temperature</th>
<th>Density in Kg / Cmt.</th>
<th>Thermal Conductivity W/m.k</th>
</tr>
</thead>
<tbody>
<tr>
<td>25°C</td>
<td>24</td>
<td>0.033</td>
</tr>
<tr>
<td>50°C</td>
<td>24</td>
<td>0.039</td>
</tr>
</tbody>
</table>

b) CLOSED CELL CROSS LINKED POLYTHYLENE (XLPE) FOAM

For Duct Pipe Insulation

<table>
<thead>
<tr>
<th>Mean Temperature</th>
<th>Density in Kg / Cmt.</th>
<th>Thermal Conductivity W/m.k</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°C</td>
<td>33</td>
<td>0.035</td>
</tr>
</tbody>
</table>

c) Expanded Polystyrene for Pipe Insulation

The density of expanded polystyrene shall not be less than 20 kg per cubic meter and the thermal conductivity shall not exceed 0.031 Kcal./hr.m C at 10°C mean temperature. Adhesive used for the setting the insulation shall be non flammable, vapour proof CPRX Compound.

The sample of insulation material shall be submitted for approval to the Engineer in Charge and the sample shall be tested for thermal conductivity values by the contractor at his own expense. Adhesive used for setting the insulation shall be non-flammable, vapour proof, CPRX compound.

3D.20 INSULATION ON SHEET METAL DUCTING

The thickness of insulation used on ducting shall be as detailed below:

Conditioned space

a) Supply Air Duct 12 mm thick Closed Cell Cross Linked Polyethylene (XLPE) Foam Insulated with factory Laminated Al PE Foil.

b) Return Air Duct 9 mm thick Closed Cell Cross Linked Polyethylene (XLPE) Foam Insulated with factory Laminated Al PE Foil.

c) Fresh Air Duct 12 mm thick Closed Cell Cross Linked Polyethylene (XLPE) Foam Insulated with factory Laminated Al PE Foil.

d) Plenums 12 mm thick Closed Cell Cross Linked Polyethylene (XLPE) Foam Insulated with factory Laminated Al PE Foil.

e) FCU Collars 12 mm thick Closed Cell Cross Linked Polyethylene (XLPE) Foam Insulated with factory Laminated Al PE Foil.
The application of insulation should be carried out in workman like manner as detailed below.

3D.21  INSULATION OF DUCTING WITH ALUMINUM FACED FIBERGLASS

**TECHNICAL SPECIFICATIONS OF CLOSED CELL, CHEMICALLY CROSS-LINKED POLYETHYLENE (XLPE) INSULATION**

The insulation material for the ducts, pipe and under-deck insulation shall be Closed Cell Cross-Linked Fire Retardant Polyethylene Foam. The thermal conductivity of the material shall not exceed 0.035 w/mk at an average temperature of 40 c.  

Thermal conductivity of the material shall not be affected by ageing, as per **DIN 52616**. The material must be tested for ageing effect in an accredited laboratory for a minimum period of five years to satisfy the ageing criteria.

The material must be in a **single layer upto 12 & 09 mm thickness** and not formed by laminating several layers.

The product will have bending trial and the dimensional stability as per **DIN 51949** and **DIN 53431** for an operating range of – 40 c to + 110 c. The density of the material shall be 33 +/- 3 kg/m or 0.030 gm/cc.

The material shall be rated as **Class 1**, as per **BS 476 PART 7**. The rating as per **DIN 4102** shall be **B1**. The **smoke density** of the material as per **AS-1530.3** shall not exceed 1. There shall be no toxicity in the emitted smoke, both under flaming and non-flaming conditions as per **AITM 3.000** (1993).

The water vapour permeability, as per **DIN 52615**, shall not exceed **0.15ng/m.sec.pa**

The material shall have a fire approval from CBRI / FIRE advisor (Govt of India)/Chief fire officer.

For providing **UV** protection the insulation shall be cladded with minimum 30 micron aluminum PE foil. The cladding shall be factory finished to avoid site work. The minimum thickness will be as per specs.

The duct surfaces will be thoroughly cleaned prior to applying the insulation. Adhesive of suitable grade shall be uniformly applied on the insulation and cured, before sticking to the duct. The insulation can be wrapped around the duct as one piece, where size does not permit the same be cut to exact width/height of duct.

The duct /pipe insulation joints will be overlapped with a self adhesive tape of the same material. The tape shall be minimum 2.5mm thick and 50mm wide.

A self adhesive strip of same material, of suitable thickness (height), to cover the complete height of the flange will be provided around the flanges and the flange joint neatly covered with insulation, so as to reduce heat loss through flages, in addition to covering the flange connection/joint.

3D.22  ACOUSTIC LINING OF DUCT.

- Material shall be engineered Nitrile Rubber open cell foam
- The Random Incidence Sound Absorption Coefficient (RISAC), tested as per ISO 354, should be minimum as per enclosed chart

<table>
<thead>
<tr>
<th>Freq (Hz)</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm</td>
<td>0.03</td>
<td>0.04</td>
<td>0.14</td>
<td>0.04</td>
<td>0.88</td>
<td>1.00</td>
<td>0.35</td>
</tr>
<tr>
<td>15 mm</td>
<td>0.01</td>
<td>0.09</td>
<td>0.29</td>
<td>0.74</td>
<td>1.08</td>
<td>0.83</td>
<td>0.55</td>
</tr>
<tr>
<td>20 mm</td>
<td>0.04</td>
<td>0.13</td>
<td>0.4</td>
<td>0.9</td>
<td>1.04</td>
<td>0.90</td>
<td>0.60</td>
</tr>
<tr>
<td>25 mm</td>
<td>0.02</td>
<td>0.25</td>
<td>0.86</td>
<td>1.14</td>
<td>0.88</td>
<td>0.99</td>
<td>0.80</td>
</tr>
<tr>
<td>30 mm</td>
<td>0.07</td>
<td>0.32</td>
<td>0.99</td>
<td>1.16</td>
<td>0.93</td>
<td>1.08</td>
<td>0.85</td>
</tr>
<tr>
<td>50 mm</td>
<td>0.23</td>
<td>0.73</td>
<td>1.29</td>
<td>0.99</td>
<td>1.09</td>
<td>1.11</td>
<td>1.05</td>
</tr>
</tbody>
</table>
The material should be fibre free
The density of the same shall be within 140-180 Kg/m\(^3\)
It should have Microban\(^*\); antimicrobial product protection, and should pass Fungi Resistance as per ASTM G 21 and Bacterial Resistance as per ASTM E 2180.
The material should have a thermal conductivity not exceeding 0.047 W/m.K @ 20 Deg. C
The material should withstand maximum surface temperature of +850C and minimum surface temperature of -200C
The material should conform to Class 1 rating for surface spread of Flame in accordance to BS 476 Part 7 & UL 94 (HBF, HF 1 & HF 2) in accordance to UL 94, 1996.
The material should pass Air Erosion Resistance Test in accordance to ASTM Standard C 1071-05 (section 12.7).

Thickness of the material shall be as specified for the individual application. The insulation should be installed as per manufacturer’s recommendation.

3D.23 REFRIGERANT PIPE INSULATION

a.) Refrigerant Pipe Insulation

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 25 mm /19 mm thick Nitrile rubber Insulation as specified in Detailed Bill Of quantities.

3D.24 DRAIN PIPE INSULATION

a.) Drain Pipe Insulation

Drain pipes carrying condensate water shall be insulated with 6 mm thick XLPE Insulationmr.
1.0 This section deals with supply, erection, testing & balancing of GI sheet metal duct work and air registers conforming to specifications as given below:

2.1 MATERIAL FOR DUCTING

The duct shall be fabricated out of galvanised sheet, class VIII (Zinc coating 120 gm/m²) as per the parameters given below which are conforming to IS 655-1963.

<table>
<thead>
<tr>
<th>MAXIMUM SIDE (mm)</th>
<th>THICKNESS (mm)</th>
<th>TYPE OF TRANSVERSE JOINT</th>
<th>BRACING CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 300</td>
<td>0.63</td>
<td>S-drive, pocket or bar slips, on 2.5m centers</td>
<td>None</td>
</tr>
<tr>
<td>301 to 600</td>
<td>0.63</td>
<td>S-drive, pocket or bar slips, on 2.5m centres</td>
<td>None</td>
</tr>
<tr>
<td>601 to 750</td>
<td>0.63</td>
<td>S-drive, 25mm pocket or 25 mm bar slips on 2.5m centres</td>
<td></td>
</tr>
<tr>
<td>751 to 1000</td>
<td>0.80</td>
<td>Drive, 25-mm pocket or 25mm bar slips, on 2.5 m centres 40 x 40 mm angle connections, or 40-mm bar slips, with 35 x 3 mm bar reinforcing on 2.5 m centres.</td>
<td>25 x 25 x 3 mm angles, 1.2 m from joint</td>
</tr>
<tr>
<td>1001 to 1500</td>
<td></td>
<td></td>
<td>40 x 40 x 3 mm angles, 1.2 m from joints</td>
</tr>
<tr>
<td>1501 to 2250</td>
<td>1.00</td>
<td>40 x 40 mm angle connections, or 40-mm bar slips, 1 m maximum centres with 35 x 3 mm bar reinforcing.</td>
<td>40 x 40 x 3 mm diagonal angles, or 40 x 40 x 3 mm angle 60 cm from joint.</td>
</tr>
<tr>
<td>2250 to above*</td>
<td>1.25</td>
<td>50 x 50 mm angle connections, or 40 mm pocket or 40 mm bar slips, 1 m maximum centres with 35 x 3 mm bar reinforcing.</td>
<td>40 x 40 x 4 mm diagonal angles, or 40 x 40 x 3 mm angles, 60 cm from joint.</td>
</tr>
</tbody>
</table>

* Ducts 2250 mm and larger require special field study for hanging and supporting methods.

In addition to above the following points should be also taken into account while fabrication of ducts.

a) All ducts of size larger than 450mm shall be cross broken.

b) All ducts shall be supported from the ceiling / slab by means of MS rods of dia 9mm with MS angle of size 40 x 40 x 5 mm at the bottom with neoprene pad in between the duct & MS angle. The ducts shall...
be suspended from the ceiling with the help of dash fasteners. Provision for necessary ancillary materials required for hanging the ducts shall be arranged by the contractor.

c) The vanes shall be provided wherever required and shall be securely fastened to prevent noise & vibration.

d) The rubber gasket shall be installed between duct flanges in all connections and joints.

e) All flanges and supports should be primer coated.

f) The flexible joints shall be fitted to the delivery side of AHU fans with Fire Retardant Double canvass. The length of flexible joints should not be less than 150 mm and not more than 300 mm between faces.

g) The ducting work can be modified if deemed necessary in consultation with the Engineer in Charge to suit actual site conditions in the building.

**NOTE:** In case angle iron supports are not feasible to be installed for supporting the ducts due to height constraint then the contractor shall support the ducts with M.S flats of at least double the thickness of the angle iron supports.

### 3.1 FRESH AIR INTAKE LOUVERS WITH BIRD SCREEN

The fresh air intake louvers at least 50mm deep will be made of powder coated extruded aluminum construction. Bird / insect screen will be provided with the intake louvers. The blades shall be inclined at 45 degree on a 40mm blade pitch to minimize water ingress. The lowest blade of the assembly shall be extended out slightly to facilitate disposal of rain water without falling on door / wall on which it is mounted.

The intake louvers shall be provided with factory fitted aluminum construction volume control dampers in black anodised finish.

### 4.2 PAINTING

All ducts collar / shoot behind the grills / diffuser shall be given at least two coats oil black enamel paints.

### 5.3 TESTING

The complete duct system shall be tested for air leakage & complete air distribution system shall be balanced in accordance with air quantities indicated on the approved drawing.

**END OF SECTION – HVX 3E**
STANDARD SPECIFICATION ON REFRIGERANT PIPING WORK

This section deals with supply, installation, testing & commissioning of refrigerant piping as detailed below in specifications.

1.10 REFRIGERANT PIPING

All refrigerant piping for the air conditioning system shall be constructed from soft seamless upto 19.1mm and hard drawn copper refrigerant pipes for above 19.1mm with copper fittings and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 20Kg per sq.cm and 10 Kg per sq.cm (low side). Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum if 700mm hg and held for 24 hours.

The air-conditioning system supplier shall be design sizes and erect proper interconnections of the complete refrigerant circuit.

The thickness of copper piping shall not be less than 20gauge for pipes up to 19.1mm and 18 guage for bigger sizes

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed there on.

The OD wall thicknesses & wall thickness size of Copper refrigerant piping shall be as follows:

Outside Diameter (mm) Wall Thickness (G)

<table>
<thead>
<tr>
<th>Outside Diameter (mm)</th>
<th>Wall Thickness (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 41.3</td>
<td>18</td>
</tr>
<tr>
<td>b) 34.9</td>
<td>18</td>
</tr>
<tr>
<td>c) 19.1</td>
<td>20</td>
</tr>
<tr>
<td>d) 15.90</td>
<td>20</td>
</tr>
<tr>
<td>e) 12.70</td>
<td>20</td>
</tr>
<tr>
<td>f) 9.5</td>
<td>20</td>
</tr>
<tr>
<td>g) 6.4</td>
<td>20</td>
</tr>
</tbody>
</table>

END OF SECTION –HVX 3F
This section deals with supply, installation, testing & commissioning of Motor Control Centre (MV panel) & shall be manufactured by CPRI approved vendors. The power / control cabling & earthing work shall be carried out as per the specification given below:

**SCOPE**

All work shall confirm to CPWD specification, Indian Electricity Act (amended up to date), I.S. code of practices local rules and regulations etc. Power cabling shall be carried out with approved make of cables as indicated in the List of approved make of equipment / materials and shall be of grade 1100 volts, PVC insulated & sheathed, armoured aluminum conductors cables. Control cabling shall be of approved make and shall be of grade 1100 volts, PVC insulated & sheathed, copper conductor armoured multicore cables as specified in B.O.Q.

**MOTOR CONTROL CENTRE (MV PANEL)**

Motor control centre (MV Panel) floor mounted extendable type & wall mounted AHU sub-panel shall be fabricated out of 14G C.R.C.A. Sheet. These panels shall be cubical sectionalised type, totally enclosed dust & vermin proof. Gaskets shall be provided in all joints to prevent dust to reach the internals of the panels to make it completely dust proof. The degree of protections for panels shall be IP 52 for indoor applications and IP 55 for outdoor applications as per IS:2147.

These panel (MV) shall be suitable for voltages up to 500 volts, three phase 50 Hz, 4 wire supply capable of functioning satisfactorily in temperature ranging up to 45 to 50 degree centigrade and rupturing capacity suitable for connected load & design should be type tested for 42 KA fault level. All joints of panels shall be welded and braced as necessary to provide a rigid support for all components. The base channel provided in the floor mounted MV panel shall be 75mm high & a clear space of 200mm between the floor and the bottom most part of the unit shall be provided. The panel shall be correctly positioned. Self-threading screws shall not be used in the construction of control panels. Appropriate knock-out holes of proper sizes shall be provided for incoming and outgoing cables. The facility for bottom or top entry of cables in the panels shall be provided. Necessary cables clamps shall provided for holding the cables in position.

All power/control wiring inside the panel shall be colour coded and control wiring ferruled for identification purpose. All labeling shall be provided in engraved anodized aluminum strips on the front face of the panel.

Each circuit breaker shall be housed in separate compartments. It shall have steel sheets on top and bottom of compartment. The steel sheet hinged door shall be interlocked with the circuit breaker on the “ON” position. When the breaker is on the “ON” position, suitable preventive measures shall be provided, such as interlocks, to prevent the breaker from being drawn out. When the breaker is in “ON” position steel sheet shall be provided between the tiers in the vertical section. The door of this compartment shall not form part of the draw out arrangements.

**BUS-BARS**

The bus-bar and its connections shall be aluminum Electrolytic grade E-91 as per IS: 5082 and shall be of rectangular section. The amperage capacity of aluminium bus bar shall be 1A / Sq. mm. These should be suitable for full load current for phase bus-bar and neutral bus-bar shall be of half rated current capacity. The bus-bar should have provision on either side for extension. The bus-bar should be sleeved with colour coded heat shrinkable PVC sleeve. Bus-bar supports shall be of fibre glass reinforced thermosetting polyester having in built and tracking barriers to break the path of conducting dust through moulded ribs.
In panels bus-bar connections shall be done by drilling holes with cadmium coated bolts and nuts. Extra cross section shall be provided to compensate drilling of the holes. Insulated aluminum strips of suitable size of full rated current capacity shall be used for interconnecting bus-bar and breaker.

A horizontal / vertical wire way shall be provided for interconnecting control wiring between different vertical sections.

The terminal blocks shall be used for outgoing terminals and neutral link at a suitable located place in the control panel. Separate compartments for outgoing and incoming cable shall be provided. The current transformers of all instruments shall be mounted with terminal blocks.

All live parts including incoming and outgoing link / terminals should be totally shrouded by means of non hygroscopic and fire retardant material.

1.40 ROTARY SWITCH / SELECTOR SWITCH / SWITCHES / HRC FUSES / STARTERS / SINGLE PHASE PREVENTERS / TOGGLE SWITCH.

These shall be of approved make and conforming to relevant ISI standard. The rupturing capacity of HRC fuses should not less than 80 KA and in case of switches it should be 60 Amps maximum.

1.50 CURRENT TRANSFORMER

The current transformers shall have accuracy of class I and 5P10 / 10P10 and suitable VA burden for operation of the connected meters and relays.

1.51 OVERLOAD RELAYS

All the motors shall have overload relay protections conforming to relevant IS.

1.52 TIME DELAY RELAYS

These shall be adjustable type with time delay adjustments of 0-180 or as per manufacturers standards.

1.53 INDICATING LAMPS AND METERING

These shall confirm to BS37 & BS39. All meters shall be flush mounted and draw-out type. The indicating lamp shall be filament type and with very low burden & economy resistor.

1.54 VOLTMETER AND AMMETERS

Motor Control Centre (MV Panel) shall have flush type voltmeter & ammeter of size 96 x 96 mm as detailed in B.O.Q.

1.55 PUSH BUTTON STATIONS

These shall be suitable for panel mounting and accessible from front without opening. These shall be provided for manual starting and stopping of motors/equipments as per normal practices. The contacts shall be suitable for 6AMP current capacity.

1.56 CONDUITS

These shall be preferable made of mild steel, stove enameled from inside and outside with minimum wall thickness of 1.6 mm for conduits up to dia of 25mm and 2 mm for conduits above 25 mm diameter.
1.57 CABLES

These shall be PVC insulated, pre-sheathed, aluminum conductor armoured cables as per IS:694 and as per list of approved make of equipment / materials. Control Cables shall be multi-core PVC-insulated PVC sheathed copper conductor and armoured cables of approved make only.

1.58 LAYING OF CABLES

These shall be laid as Indian Standard code of practice. All cables shall be laid on 16G Cadmium Plated U shaped Channel 40mm x 20mm cable trays. In case more than one cable is running, then proper space in between the two cables shall be provided to avoid loss of current carrying capacity. While cables are running on walls, proper saddles must be provided.

1.59 WIRE SIZES

Single stand PVC-copper conductor wires shall be used inside the control panel for interconnecting different components. All wires shall be neatly dressed and coloured beads shall be provided for easy identification in control wiring. The minimum size of control wiring shall be 1.5sq.mm. Testing of panels as per code of practice shall be done at works by AC contractor before inspection & dispatch to site.

1.60 DRAWINGS

Necessary drawings of all control panels and wiring of equipment etc., shall be submitted by the A.C contractor for approval of the Engineer in Charge. On final completion of job and before handing over of AC System As Built Drawings shall be submitted to the Department.

1.61 TESTING

The complete electrical installation shall be tested in accordance with relevant ISI codes in presence of Electrical Supervisor of the Department before commissioning of plant.

1.62 PAINTING OF PANELS

All sheet metal enclosures shall be powder coated only after de-rusting & hot-dip phosphating degreasing etc. at works only.

NOTE: Rubber mats of 1100 volts shall be laid in front of all switch boards as specified in BOQ.

1.70 SIZES OF POWER CABLELING

The following size of power cabling shall be used only:

<table>
<thead>
<tr>
<th>HP of Motors</th>
<th>Cable size</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Up to 5 HP</td>
<td>3c x 4 sq.mm aluminium conductor armoured cable.</td>
</tr>
<tr>
<td>b) 5 to 7.5 HP</td>
<td>3c x 6sq.mm aluminium conductor armoured cable.</td>
</tr>
<tr>
<td>c) 10 to 15 HP</td>
<td>2no. 3c x 6sq.mm aluminum conductor armoured cable.</td>
</tr>
<tr>
<td>d) 20 to 25 HP</td>
<td>2 nos. 3 x 16sq.mm aluminum conductor armoured cable.</td>
</tr>
<tr>
<td>e) 30 to 35 HP</td>
<td>2 nos. 3c x 25sq.mm aluminum conductor armoured cable.</td>
</tr>
<tr>
<td>f) 40 to 50 HP</td>
<td>2 nos. 3c x 35sq.mm aluminum conductor armoured cable.</td>
</tr>
</tbody>
</table>
g) 60 HP
2 nos. 3c x 35sq.mm aluminum conductor armoured cable.

h) 75 HP
2 nos. 3c 50sq.mm aluminum conductor armoured cable.

1.71 CAPACITY OF RELAYS AND CONTACTS

The following capacity relays and contacts shall be used for various rating of motors:

<table>
<thead>
<tr>
<th>Type of Starter Contactor</th>
<th>Overload Relay</th>
<th>Current Phase Relay Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 50/60 HP Motor</td>
<td>Star Delta Starter 65 Amp. 30 - 50 Amp.</td>
<td></td>
</tr>
<tr>
<td>b) 40 HP Motor</td>
<td>Star Delta Starter 45 Amp. 20-33 Amp.</td>
<td></td>
</tr>
<tr>
<td>c) 30 HP Motor</td>
<td>Star Delta Starter 45 Amp. 20-33 Amp.</td>
<td></td>
</tr>
<tr>
<td>d) 25 HP Motor</td>
<td>Star Delta Starter 32 Amp. 14-23 Amp.</td>
<td></td>
</tr>
<tr>
<td>e) 20 HP Motor</td>
<td>Star Delta Starter 32 Amp. 14-23 Amp.</td>
<td></td>
</tr>
<tr>
<td>f) 15 HP Motor</td>
<td>Star Delta Starter 25 Amp. 9-15 Amp.</td>
<td></td>
</tr>
<tr>
<td>g) 10 HP Motor</td>
<td>Star Delta Starter 16 Amp. 6-10 Amp.</td>
<td></td>
</tr>
<tr>
<td>h) 7.5 HP Motor</td>
<td>D.O.L. Starter 16 Amp. 9-15 Amp.</td>
<td></td>
</tr>
<tr>
<td>i) 5 HP Motor</td>
<td>D.O.L. Starter 16 Amp. 6-10 Amp.</td>
<td></td>
</tr>
</tbody>
</table>

1.72 EARTHING

The earthing of all equipments shall be carried out by Copper strips / wires as mentioned in Bill of Quantities. All panels / three phase motors shall be earthed with two number distinct and independent Copper strips / wires of the following sizes:

1. Motor upto 5.5 KW
   3 sq. mm Copper Wire

2. Motor 7.5 to 12 KW
   4 sq. mm Copper Wire

3. Motor 12 to 50 KW
   25x3 mm Copper Strip

4. Motor 51 to 89 KW
   32x6 mm Copper Strip

The earthing connections shall be connected to main earth station or main earth grid. The earth connections shall be connected to equipments after removal of paint, grease etc.

END OF SECTION - HVX 3G
1.00 SCOPE

This section deals with supply, installation, testing and commissioning of various types of blower for forced ventilation of required capacities and sizes as enumerated under Detailed Bill of Quantities & Schedule of equipment and conforming to the following specifications.

2.10 TYPE

The blower shall be of Tube Axial Flow fans / Centrifugal Fans / Inline fans / Propeller Fans with or without ducting system & shall be of floor mounted / ceiling hung type.

3.11 CAPACITY

The capacity of Tube Axial Flow fans / Centrifugal Fans / Inline fans / Propeller Fans, diameter, maximum motor H.P & static pressure etc. shall be according to schedule of equipment & Bill of Quantities.

3.50 IN-LINE FANS

Inline fans shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators, direction of discharge and rotation position shall be as per the job requirement and shall be marked on the fan assembly. Housing shall be constructed of hot rolled GSS sheet metal construction. Housing metal parts shall be either spot-welded or screwed or mounted together with rivets. Indication showing rotation arrow and make, model number and duty conditions of the fan shall be available on the housing. Fan wheel shall be forward curved type, statically and dynamically balanced. The fan shall be provided with ball bearings can be used in any mounting position at maximum indicated temperature.

7.60 ACCESSORIES.

All necessary accessories shall be provided for proper operation and shall also include as part of Unit Price.

7.61 Dunlop cushy foot vibration isolators for the blowers.

7.62 Double canvas connections at the outlets of each fan

7.63 Nuts, Bolts, Shims etc. as required for the grouting of the equipment.

7.64 Slide rails for mounting the motor and belt adjustments.

7.65 Bird Screens in the Inlet.

7.66 Detachable and washable fresh air filters at the inlets.

END OF SECTION HVX-3H
BASIS OF DESIGN

Location – Guwahati

Latitude – 26.11 Deg. North

Altitude – 55 Meter

A. Outside Design Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>DBT °C</th>
<th>WBT °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer / Monsoon / Winter</td>
<td>32.2/31.1/11.1</td>
<td>25.6/27.8/8.3</td>
</tr>
</tbody>
</table>

B. Inside Design Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>DBT °C</th>
<th>RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer / Monsoon</td>
<td>22.22±1</td>
<td>Around 60%</td>
</tr>
</tbody>
</table>

C. POWER SUPPLY: Stabilised three phase four wire AC supply i.e. 415 Volts ± 10 % & 50 Hz ± 5 % with double earthing shall be made available near each outdoor unit & Single-phase power supply with earthing near each indoor units.

D. Parameters for Heat load Application

i) Light Load – 1 W / Sq Ft.

ii) Occupancy as per Furniture Layout.

iii) Fresh Air – as per Ashrae 62.1-2007

iv) Glass Solar Gain – 0.45

v) Glass U Factor - 0.75 BTU/HR/SFT/°F.

vi) Wall U Factor - 0.36 BTU/HR/SFT/°F.

vii) Partition Load   - 0.32 BTU/HR/SFT/°F.

viii) Ceiling / Floor Load - 0.46 BTU/HR/SFT/°F.

ix) Exposed Roof - 0.12 BTU/HR/SFT/°F.

x) Equipment Load – As per Occupancy / 0.15 W Per Computer
## Parameters For Air-conditioning

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Floor &amp; Area Name</th>
<th>Area SMT</th>
<th>TR Summer (Total)</th>
<th>TR Monsson (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ground Floor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Conference Room, Seminar</td>
<td>172</td>
<td>10.95</td>
<td>12.01</td>
</tr>
<tr>
<td>2</td>
<td>Entrance Lobby, Recreation</td>
<td>267</td>
<td>14.04</td>
<td>15.12</td>
</tr>
<tr>
<td>3</td>
<td>Corridor</td>
<td>102</td>
<td>2.95</td>
<td>3.00</td>
</tr>
<tr>
<td>4</td>
<td>Control</td>
<td>13</td>
<td>0.58</td>
<td>0.61</td>
</tr>
<tr>
<td>5</td>
<td>Main Lab-1</td>
<td>58</td>
<td>3.74</td>
<td>4.07</td>
</tr>
<tr>
<td>6</td>
<td>Recreation Area</td>
<td>30</td>
<td>1.99</td>
<td>2.18</td>
</tr>
<tr>
<td>7</td>
<td>Main Lab-2</td>
<td>72</td>
<td>4.29</td>
<td>4.70</td>
</tr>
<tr>
<td>8</td>
<td>Office</td>
<td>13</td>
<td>0.62</td>
<td>0.65</td>
</tr>
<tr>
<td>9</td>
<td>Maintenance</td>
<td>93</td>
<td>4.49</td>
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# Third Floor

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<td>Monsson (Total)</td>
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<td>-----</td>
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<td>Room</td>
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<td>Room</td>
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<td>Library Reading Room</td>
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| Total | 693 | 34.9 | 37.17 |

Grand Total | 3930 | 194 | 208 |

E Refrigeration Load

The total refrigeration load based on the parameters given above works out to 208 TR approx.

F. SCHEME FOR CENTRALISED AIR-CONDITIONING SYSTEM – VRF SYSTEM

It is proposed to install 291 HP actual capacity Imported Inverter type Outdoor unit to cater to the above refrigeration load.

These Inverter type machine shall work in conjunction with 10 Nos. Indoor unit with imported Y-Joints & Copper Refrigerant Piping with fittings insulated.

The outdoor units shall be located on terrace and locations of units shall be decided after detailed drawings are finalized by your architect.

G SCHEME FOR VENTILATION SYSTEM FOR TOILETS

It is proposed to install number of ducted Inline Fans / Axial Fans on the terrace or at suitable location to exhaust the air from toilets. Detailed Engineering calculation after finalization of Toilet detail AS PER boq

END OF SECTION –HVX - 4A
<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment Description</th>
<th>Approved Makes</th>
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<tbody>
<tr>
<td>1</td>
<td>Variable Refrigerant Volume / Variable refrigerant Flow Units</td>
<td>Daikin / Mitsubishi Electric / LG / Samsung / Toshiba / Hitachi.</td>
</tr>
<tr>
<td></td>
<td>(Brands to be approved by Department)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Copper Y joints and fittings</td>
<td>Daikin / LG / Samsung / Toshiba / Hitachi.</td>
</tr>
<tr>
<td>3</td>
<td>AHU Type Indoor Units</td>
<td>Daikin / LG / Samsung / Toshiba / Hitachi.</td>
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<tr>
<td>4</td>
<td>M.C.B. &amp; MCCB</td>
<td>GE / Schneider / Siemens</td>
</tr>
<tr>
<td>5</td>
<td>Power Cable</td>
<td>NICCO / RPG / CCI / KEI</td>
</tr>
<tr>
<td>6</td>
<td>Control / Transmission Cable</td>
<td>RR / KEI / NICCO</td>
</tr>
<tr>
<td>7</td>
<td>Voltmeter / Ammeter</td>
<td>A.E. / IMP.</td>
</tr>
<tr>
<td>8</td>
<td>Switches</td>
<td>L&amp;T / Siemens / GE</td>
</tr>
<tr>
<td>9</td>
<td>HRC Fuse and Fittings</td>
<td>L&amp;T / Siemens / GE</td>
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<tr>
<td>10</td>
<td>Current Transformer</td>
<td>A.E. / Kappa / Precise</td>
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<td>11</td>
<td>Contactors</td>
<td>L&amp;T / Siemens / GE</td>
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<td>12</td>
<td>Starter</td>
<td>L&amp;T / Siemens / GE</td>
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<tr>
<td>13</td>
<td>Overload Relays</td>
<td>L&amp;T / Siemens / GE</td>
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<td>Indicating Lights</td>
<td>Siemens / L&amp;T</td>
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<td>15</td>
<td>Selector / Toggle switch</td>
<td>Kaycee / L&amp;T</td>
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<td>16</td>
<td>Change Over switch</td>
<td>Elecon / L&amp;T</td>
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<td>17</td>
<td>Time Delay Device</td>
<td>Siemens / L&amp;T</td>
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<td>18</td>
<td>Single Phase Device</td>
<td>L&amp;T / Minilec</td>
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<td>19</td>
<td>Make of Electrical Panel, Sub Panel</td>
<td>KEPL / EAP / RR Control / Essar universal (manufacturer should be CPRI Approved)</td>
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<td>20</td>
<td>GI Sheet</td>
<td>Sail / Tata / Jindal</td>
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<td>21</td>
<td>Refrigerant &amp; Drain Pipe Insulation</td>
<td>Armacell / K-Flex / Supreme</td>
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<td>22</td>
<td>Duct Insulation</td>
<td>Trocellin / Thermobreak / Paramount / Supreme</td>
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<td>23</td>
<td>Copper Refrigerant Piping</td>
<td>Rajco / Maxflow / Diamond</td>
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<td>Adhesive for Pipe Insulation</td>
<td>Pidilite SR-998 / 505 / Superlon</td>
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<td>25. Drain Pipe High Density Polystrene</td>
<td>- Polypack / Supreme</td>
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<td>Actuator</td>
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<td>27. Inline Fan</td>
<td>- Humidin / Airflow/ Blowtech/Nicotra Kruger.</td>
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END OF SECTION – HVX 4B
### SCHEDULE OF EQUIPMENT

#### 1.0

The capacity/rating of various equipments in this contract are given for guidance only. The AC contractor shall check in detail the design parameters against selection of equipment. The AC contractor shall be responsible for maintaining the desired inside conditions with the equipments selected & offered by him and shall not deprive him of the responsibility if selection of equipment is not thoroughly checked. In case of shortfall the AC contractor shall replace / modify equipment for achieving desired parameter without any extra cost to owner / employer. The contractor would be bound to replace the equipment / equipments selected by him if design condition is not achieved by the AC System offered & installed by him.

#### 1.1 Variable Refrigerant Volume Air-cooled Unit (With Inverter Compressor Control)

**A)** Outdoor Unit (Imported With Inverter Compressor Control)

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<thead>
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<th>S. No.</th>
<th>Unit</th>
<th>Unit</th>
<th>Condition Of Services</th>
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<tbody>
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<td>a)</td>
<td>Type</td>
<td>--</td>
<td>Heat Pump Type (Cooling &amp; Heating)</td>
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<td>b)</td>
<td>Total Quantity</td>
<td>Nos.</td>
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</tr>
<tr>
<td>c)</td>
<td>Capacity (Cooling &amp; Heating)</td>
<td>HP (Actual)</td>
<td>20 (1 No. M/C)</td>
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<td></td>
<td>HP (Actual)</td>
<td>28 (5 No. M/C)</td>
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<td></td>
<td>HP (Actual)</td>
<td>30 (1 No. M/C)</td>
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<td>HP (Actual)</td>
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<tr>
<td>d)</td>
<td>Capacity (Heating)</td>
<td>KW</td>
<td>As Per Std.</td>
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<tr>
<td>e)</td>
<td>Connectable No. of Possible indoor unit</td>
<td>Nos.</td>
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<tr>
<td>f)</td>
<td>Air entering condenser</td>
<td>Deg CDB</td>
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<td>g)</td>
<td>Electric Supply</td>
<td>--</td>
<td>-- 415 V/3 Ph/50 Hz--</td>
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<tr>
<td>h)</td>
<td>Permissible Refrigerant Pipe Length for Each Out Door Unit</td>
<td>Length</td>
<td>100 Meter Minimum</td>
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**B)** Indoor Units (Ceiling Suspended / Floor Mounted Duct Type)

Please Refer Basis of Design HVX-4A

#### 1.2 G.S.S. DUCTING

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<td>Code of fabrication</td>
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<td>c)</td>
<td>Material of hangers</td>
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<td>d)</td>
<td>Quantity of sheet</td>
<td>Lock forming quality</td>
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#### 1.3 INSULATION
XLPE FOAM

a) For external thermal insulation of duct As per specification

b) Density 40-60 Kg / M³

OPEN CELL NITRILE RUBBER.

a) For external thermal insulation of duct As per specification

b) Density 140-180 Kg / M³

END OF SECTION HVX-4C
Contractor should furnish technical data as mentioned below, of the equipment and accessories offered by him as per scheme, specification, schedule of equipment and bill of quantities given in the tender.

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<td>Nominal</td>
<td>KW</td>
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</tr>
<tr>
<td>2.4.2</td>
<td>Actual</td>
<td>KW</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Air Quantity</td>
<td>CMH</td>
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<tr>
<td>2.6</td>
<td>Sound level at a distance of 1m</td>
<td>DB(A)</td>
<td></td>
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<tr>
<td>2.8</td>
<td>Power consumption at rated capacity</td>
<td>KW</td>
<td></td>
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</table>

Note: Please submit Technical Data Sheet for Inline Fan etc.
List of Drawings

NIT No.: NERO/MMD/735/342  
Dated: 26.12.2018

Tender for: Manufacture, Supply, Inspection, Erection, Testing And Commissioning Of HVAC WORK IN Nanotechnology Department Building For The Project “EXTENSION OF ACADEMIC COMPLEX PHASE (V): AT IIT-GUWAHATI CAMPUS, GUWAHATI”

<table>
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<tr>
<th>Sl. No</th>
<th>Title of Drawing</th>
<th>Dated</th>
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<tbody>
<tr>
<td>1</td>
<td>Ground Floor Plan</td>
<td>19.07.2016</td>
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<tr>
<td>2</td>
<td>First Floor Plan</td>
<td>16.10.2016</td>
</tr>
<tr>
<td>3</td>
<td>Second Floor Plan (Option -1)</td>
<td>19.07.2016</td>
</tr>
<tr>
<td>4</td>
<td>Third Floor Plan</td>
<td>19.07.2016</td>
</tr>
</tbody>
</table>

Note: The drawings enclosed are as received from the Owner for general guidance only. The works shall be executed as per the detail drawings to be prepared by the contractor and finalized during execution and as per instructions of the Owner.

(Signature and seal of the Tenderer)