

INTER-UNIVERSITY ACCELERATOR CENTRE

(An Autonomous Centre of UGC)
Aruna Asaf Ali Marg, New Delhi-110 067

NOTICE INVITING E-TENDER

TENDER NO: IUAC/NIT/53/BKG/2019-20

Dated: 04/02/2020

Electronic bids are invited through E-Procurement Portal under two bid systems from eligible / reputed parties for the work **“Up-gradation of Existing running AC plant Including Dismantling of Old Equipments and Supply, Installation, Testing & Commissioning of 2 Nos. of new 250 TR of Water Cooled Screw Type Water Chilling Units, condenser / Chilled Water Pumps, Cooling Towers, Electrical Main Panel, Including Foundation, Piping, Electrical Connections etc.”** at IUAC, New Delhi - 110 067.

Tender Documents may be downloaded from Central Public Procurement Portal <http://eprocure.gov.in/eprocure/app> and www.iuac.res.in

Aspiring Bidders who have not enrolled / registered in e-procurement portal should enroll / register before participating through the website <http://eprocure.gov.in/eprocure/app>

Bids shall be submitted online only at CPPP website: <http://eprocure.gov.in/eprocure/app>. Tenderer/Contractors are advised to follow the instructions provided in the e-procurement portal. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

IUAC reserves the right to accept / reject any/all tenders in part/full without assigning any reasons thereof.

Bidder has to select the payment option as **“offline”** to pay the tender fee and EMD as applicable. The Earnest Money Deposit and tender cost shall be in the form of demand draft issued in favour of **“Inter-University Accelerator Centre, New Delhi”** and it should be deposited at IUAC before the bid opening. Bidders registered with MSME/NSIC are exempted from payments of EMD & tender fee. Copy of valid registration certificate should be uploaded.

Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BOQ format with the tender document, then the same is to be downloaded and to be filled and submit it online without modifying the format. If the BOQ file is found to be modified by the bidder, the bid will be rejected.

Any Corrigendum / Amendments in respect of above tender shall be issued on website <https://eprocure.gov.in> only. Bidders should take into account any corrigendum published on the tender document before submitting their bids.

E-TENDER DOCUMENT

Name of Work	Up-gradation of Existing running AC plant Including Dismantling of Old Equipments, Supply, Installation, Testing & Commissioning of 2 Nos. of 250 TR of Water Cooled Screw Type Water Chilling Units, condenser / Chilled Water Pumps, Cooling Towers, Electrical Main Panel, Including Foundation, Piping, Electrical Connections etc.” at IUAC, New Delhi - 110 067
Tender No.	IUAC/NIT/53/BKG/2019-20
Tender Value/Estimate only	Rs. 2,25,00,000 (Rupees Two Crores and Twenty five lacs only)
Earnest Money Deposit	Rs.4,50,000/- (Rupees Four Lacs and Fifty Thousands only)
Tender cost	Rs. 500/- (Rupees five hundred only)
Bid Submission End date	27/02/2020 at 3.00 p.m.
Technical Bid (Part-A) Opening Date	28/02/2020 at 3.30 p.m.
Price Bid (Part-B) Opening Date	To be intimated later to technically qualified bidders.
Contact Persons	M. B. Joseph, Administrative Officer (S&P) e-mail: joseph@iuac.res.in Bishamber Kumar, E-mail- bkg.iuac@gmail.com , Ph- 011-24126018 / 6022

GENERAL CONDITIONS OF TENDER:

1. **Submission of Tender** : Tenders should be uploaded in CPP Portal in two Parts separately i.e. "Technical bid" (Part-A) and "Price bid" (Part-B).

No other mode of submission will be accepted. **Any clarifications / amendments / corrigendum etc., to NIT before last date of submission of bid will only be available on website: <http://eprocure.gov.in>. Therefore bidders are advised to keep visiting our website.**

2. **Technical Bid (Part-A)** : In this bid, the bidder should upload his company profile, history and structure of firm, name of directors/partners/proprietor with technical staff, list of plant, machinery & tools in his possession, copies of work orders successfully executed during the last seven years.

The following essential documents are required for technical qualification:

(a) Earnest Money Deposit.

b) Copies of Work Orders of similar HVAC Plant works wherein there should be minimum one work of SITC of 1 nos of 140 TR capacity chilling unit including associated pumps, piping, cooling tower etc. successfully executed during the last 7 years for reputed Public Ltd. Companies, Public Sector, Govt. Institutions and autonomous bodies in the following manner :

Three similar works, each of value not less than Rs. 90 lacs.

OR

Two similar works, each of value not less than Rs. 112 lacs.

OR

One similar work of value not less than Rs. 180 lacs.

Satisfactory work completion certificate with contract details for the work order should be uploaded for eligibility. The work order and completion certificate should be for the same work.

c) Copy of GST Registration Certificate.

d) Tender acceptance letter (attached Annexure - IV) on bidder's letter head duly signed & stamped by the bidder as acceptance of all terms & condition of tender

e) Others – i. No deviations in respect of NIT conditions are acceptable. However technical discrepancy, if any, shall be clearly mentioned in Technical Bid (Part-A).

ii.) List of Make / Model of Offered Items.

iii) Technical data sheet.

iv) Undertaking stating that “ I undertake that I have visited the place where the Chilling Units, Water pumps, cooling towers, electrical panel etc. shall be installed. I undertake that the equipment offered by me shall be installed by me in the same space with required maintenance area around.”

IUAC reserves the right to inspect the sites/work places as claimed by the bidders in the technical bid, where they have executed similar works successfully.

3. **Price Bid (Part B)** : In this bid the bidder is required to quote his items rates/prices for the works mentioned in the standard .XLS BOQ format which is part of this tender. Prices shall also include scope / works mentioned in the scope of work, General &

technical details / specifications. The rates/price should be inclusive of all material cost, labour, services, charges for the plant / machinery / tools & tackles required for work, freight, transportation, loading, unloading, shifting, Insurance, Govt. duties, **Excluding GST**, levies etc. up to IUAC site basis.

IUAC is exempted from GST and Customs duty. Necessary Exemption certificate shall be provided by IUAC wherever applicable.

Quoted rates are deemed to cover all the items & works which may be required for complete functioning of equipments, even though they may not have been explicitly mentioned in the scope and schedule of works.

It is mandatory on bidder to quote all item rates as asked for in the BOQ / PRICE schedule. Failure to adhere to this condition will lead to rejection of tender. The bidders should quote unconditional rates.

4. **Earnest Money Deposit:** An earnest money of Rs 4,50,000 /- (Rupees four lacs and fifty thousands only) has to be submitted at IUAC before opening the Technical bid (Part A). The EMD shall be only in the form of Bank Draft payable to **Inter - University Accelerator Centre payable at New Delhi**. Tender without EMD will be rejected. EMD of technically disqualified bidders will be returned within 15 days from the date of evaluation of the technical bids. The refund of EMD to the unsuccessful bidders onward shall be made within 15 days from the date of opening of price bid. The refund of EMD of the successful lowest bidder (L1) shall be held back with centre as a part of security deposit and will be released after completion of the works and site clearance.
5. **Exemption from EMD:** Companies registered with National Small Scale Industries Corporation (NSIC) and Micro, Small & Medium Enterprises (MSME) will be given relaxation as per Govt. rules. Copy of relevant exemption certificates shall be uploaded.
6. **Validity of Tender:** Tender shall be valid for our acceptance without any change in rates and NIT conditions for a period of 120 days from the date of opening of price bid.
7. **Escalation:** Rates shall be firm. No escalation over and above items rates quoted by the bidder shall be paid till the completion of work under any circumstance.
8. **Performance Security:** The tenderer whose tender is accepted, will be required to furnish performance security deposit of 5% (Five Percent) of the tendered amount in the form of Bank Draft / Bank Guarantee / FDR from a nationalised/scheduled bank in favour of Inter-University accelerator Centre, at New Delhi, within the period of 15 days from issue of LOI / PO. If tenderer fails to deposit the said performance security within the period as indicated, the Earnest Money deposited by the tenderer shall be forfeited automatically without any notice to the tenderer and without prejudice to any other right or remedy. Performance guarantee shall be valid throughout the agreement period and 3 months beyond. IUAC shall not be liable to pay any bank charges, commissions or interest. Performance Security shall be returned to the bidder after satisfactory execution of the order and taking over the systems by IUAC.
9. **Terms of Payment : For Chilling units and spares (If Imported):** – Letter of credit will be opened in favour of Chilling Unit manufacturer of the unit for the amount in foreign currency equivalent of rupee rates quoted in BOQ item no. 1). Before opening of LC the bank guarantee of value of 15% of the LC amount (extra then the security

deposit) valid for one year in equivalent Indian rupee value, shall be deposit with the IUAC. All the charges towards LC opening, bank charges, dollar / rupee variation, custom clearance, loading / unloading Ex-IUAC shall be born by the successful bidder.

For LC opening the foreign currency / Indian Rupee conversion date will be last date of submission of tender.

For balance items : i. 60% Payment will be released after pro rata supply of material (subject to maximum of 3 bills) at site along with material & test certificates etc.

ii. 30% Payment will be released after satisfactory completion of installation, successful commissioning & acceptance of the system by IUAC .

iii. Balance 10% of the contract cost shall be held towards performance guarantee for one year from the date of satisfactory commissioning & handing over the system to IUAC. However if bidder wishes the same may be released after completion & acceptance of work and submission of bank guarantee of equivalent amount valid for one year for which documentation cost of BG will be to bidder's account.

No extra reimbursements will be made towards idle labour / overheads for non-availability of shut down. Such eventuality will need to be built into the quoted price.

10. **Extra Items:** During the execution of work, the contractor may require to execute certain additional/extra items in order to complete the job/works beyond the BOQ for which no rates are available. The payment for such extra/deviated items shall be paid as per rate approved on the basis of analysis. The cost component for rate analysis shall be (1) cost of material (2) cost of direct labour (3) Contractor over heads & profit 10%. Before execution of work, the rate analysis may be forwarded to A.O (S&P) duly certified by the IUAC representative for approval of the Director, IUAC.
11. **Completion time:** It is to be noted that round the clock operation of pelletron entirely depends on working of this plant. Therefore plant is very crucial for day to day activity of IUAC. The time shall be the essence of this contract and entire work as titled above is to be completed in all respects within a overall period of **one year** from the date of PO.

The successful bidder has to submit the time & activity chart for the completion of work. Availability of shut down will be subject to supply of all the material at site and time frame agreed upon by IUAC and to the satisfaction of IUAC engineer. Work shall be carried out in winter season only. Work may have to be carried out at night and holidays also depending on the shut down availability and no extra compensation will be given for the delays, time extensions due to non - availability of shut down.

However bidder has to depute the manpower to carry out the work in parts as and when the short time intervals are available to carry out the part of work like electric panels, branching from the header, dismantling and installation of pumps, dismantling and installation of chillers, disconnecting / connecting of old / new equipments etc within the agreed time period else the L.D. Will be applicable.

The work shall be carried in line with the The work may have to be carried out in parts depending upon the shut available.

Also note that the work shall be done without affecting the running system. You shall line your team as per availability of shut down from the IUAC. The work shall be done in parts subject to availability of shut down.

Any delay in completing the work for reasons attributable to the contractor is liable for liquidated damages as per clause 22 of NIT. Under the force - majeure conditions or delay due to reasons beyond control of the contractor, IUAC may grant suitable time extension for which the contractor has to request along with the justification/reasons well in advance to the Director, IUAC for approval without any prejudice to price escalation. No time extension request shall be considered after the expiry of completion period/contract. The decision of the Director will be final and binding on the bidder/contractor.

12. **Scope of Work** : Detailed terms and conditions, scope of work (Annexure - I), technical specifications (Annexure-II) etc. are enclosed with this NIT.
13. **Deviations**: No deviation from the stipulated terms and conditions will be acceptable. Tenders should be unconditional. Technical discrepancies **if any, are to be mentioned in "Part-A"** only and such exclusion will be price loaded for comparison purposes and for evaluation of L1 at the discretion of evaluation committee. It is therefore in the interest of the bidder not to have any exclusion which will have a unfair price advantage to the concerned bidder.
14. **Site Conditions** : Contractor shall acquaint himself fully with the site conditions and the working environment of IUAC before quoting his rates. No Compensation on account of any site difficulties will be entertained, at a later date, after award of the works.
15. **Correspondence** : All the correspondence in respect of tender / contractual obligation shall be made to A.O.(S&P), Inter – University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067.
16. **Guarantee/Defect liability period** : The contractor should guarantee for the works/items executed/supplied by him from the manufacturing / engineering defect and bad material/workmanship for a minimum period of 1 (one) year from the date of acceptance of the system by IUAC. During this period if any replacement of items, repairs/rectification is needed, he shall do the same free of cost to IUAC.
17. **Labour Laws**: The contractor will abide by all the rules and regulations related to labour laws, accident, workmen compensation act, workmen insurance, ESI, EPF, etc. This will be the sole responsibility of the contractor. IUAC will not be a party at any stage in any of the disputes relating to the above. In case, any liability arises due to non-conformance by the contractor, under no circumstances IUAC will be liable for the same.
18. **Rules governing the Contractor's employees working in the IUAC Premises**: The contractor's employees working inside the IUAC campus will abide by the IUAC conditions. Any damage to the IUAC property due to mishandling, carelessness on the contractor or his workman part will be recoverable from the contractor's bills.
19. **Tender rejection** : IUAC reserves the right to reject any or all the tenders in full or in part without assigning any reasons whatsoever, and the decision of the Centre in this regard will be binding on all the bidders. Tenders not complying with any of the provisions stated in this tender document are liable to be rejected. **Director, IUAC reserves the right to accept or reject any tender without assigning any reason and does not bind himself to accept the lowest tender.** Issue of bid documents does not automatically mean that the bidder is considered for the bid. No claim towards rejection will be considered.

20. **Performance of the system:** On receipt of the order, the contractor will submit the design and other details to carryout the job. Only after getting approval from IUAC, the contractor should go ahead with procurement and fabrication etc. The contractor on completion of the work will amply demonstrate the system & design parameters. He should supply the manufacturer's certificate/ instruction manual along with materials / equipments. If the equipment is supplied & installed by vendors other than manufacturers, they should submit the purchase details of items from original manufacturer like purchase order, bill particulars, equipment test and guarantee certificates etc.
21. **Specifications :** Where not specified will be as per the best industry practices, ISI marked or CPWD Technical Specifications which ever is superior. In case of any variation in specifications at different places in NIT, the best specification will be considered. However decision of IUAC engineer will be final.
22. **Liquidated damages:** In case the work is delayed beyond the specified completion period for reasons attributable to the contractor, deductions on account of liquidated damages @ 1% of the contract value per week will be deducted subject to a maximum of 10% of the total cost excluding GST. However, in case the works are delayed beyond the scheduled completion/ contract period. IUAC reserves the right to get the work done by any other contractor at the risk and cost of the contractor and the amount along with 10 % overhead to the affect will be deductible from his bills/dues.
23. **Subletting :** The contract shall not be assigned or sublet without the written approval of the IUAC.
24. **Supervisor:** Contractor should depute a qualified supervisor dedicated for this site, who will co-ordinate work execution activities and interact with the IUAC representative responsible for supervision of work. Without a supervisor work will not be allowed.
25. **Gate Pass:** All the persons deployed by the bidder at IUAC site will have to carry valid gate passes, which will be only issued after submission of their bio-data in desired format. Any negligence/offense on their part will attract immediate removal from site.
26. The contractor will provide for all necessary materials, tools, equipment, measuring / test instruments and working consumables etc. needed for execution of the works. Safe custody of all such material will be contractor's sole responsibility. No extra charges will be paid for the same.
27. Watch and Ward of all material till the system is taken over by IUAC shall be the sole responsibility of the contractor and pilferage etc. shall be entirely to his account.
28. All the employees will have to be covered under insurance against any personal accident and IUAC will not be liable for payment of any compensation on that account.
29. Suitable lighting arrangements will have to be arranged by the Contractor at his own cost. However, IUAC will provide for power/light points at nearest available point from the place of work.
30. The work shall be carried out as per the norms set by the manufacturer of respective equipment, specification and specific instructions as may be issued by the IUAC representative responsible for work from time to time.

31. During execution of work, the contractor should follow all standard norms of safety measures/precautions to avoid accidents/damages to man, machines and buildings. Non-adherence of this clause, suitable fines, as decided by the Director, IUAC shall be imposed.
32. Manpower deployed by the contractor at our site for carrying out contracted works is strictly prohibited being associated with any other works on the campus.
33. **Challan** : No material belonging to the contractor whether consumable or non-consumable should be brought inside the IUAC campus without proper entry at the main gate nor any material should be taken out without proper gate pass issued by the centre. **List of all inwards / outwards challan to be maintained by the contractor with a copy mark to IUAC Engineer.**
34. IUAC will provide free water and electricity during installation work at IUAC, at one point. The contractor has to make his own arrangements for installation of power and water from that point as per his requirements.
35. Tender once submitted will remain with the centre and will never be returned to the bidders.
36. **Termination of Contract:** The Director, IUAC reserves the right to terminate the contract on account of poor workmanship, failure to mobilise the site within 30 days, non-compliance of set norms/ specifications for the works, delay in progress of work, violation of any contract provisions by the contractor. In such case the contractor is liable to pay liquidated damages @ 10% of tendered value besides performance security / EMD.
37. **Resolution of Dispute:** All disputes arising out of this contract shall be referred to the sole arbitration of a person selected by the contractor out of the panel of three persons nominated by the Director IUAC, and his decision /award shall be final and binding on both parties. The Arbitration shall be governed under the Indian Arbitration Act 1996 or any statutory modifications or re-enactment thereof and rules made there under and for the time being in force shall apply to the arbitration proceeding under this contract. Any dispute arising out of this contract will be subjected to jurisdiction of New Delhi/Delhi.

Accepted
(Signature of bidder)

1. Introduction

IUAC is having 4 x 101.4 TR each reciprocating water chilling units in AC Ph-I Plant to serve the air conditioning, process water requirement of Pelletron Accelerator equipments, tower, labs, beam hall & running satisfactory since 1989.

It is proposed to upgrade the existing HVAC by replacing old equipments in AC Plant with new chilling units, chilled / condenser water pumps, cooling towers, piping, valves, foundation, main electrical panel etc, to meet the enhanced cooling requirement.

2. The scope of work

It is mandatory that the bidder should visit the site where the work shall be carried out and understand the nature of work and physical space constraint before submitting the offer.

2.1 The scope of work briefly covers as following:

- a) SITC of complete functional 2 nos – 250TR, new water cooled screw type water chilling units complete with screw compressor unit, motor, evaporator, condenser, micro processor panel, unit mounted electrical star delta starter etc. including foundation, piping, electrical connections, interlock wiring, insulation etc.
- b) SITC of 2 nos - complete functional centrifugal chilled water pumps, back pull type only including pump, electric motor, base frame, flexible spacer coupling, floating foundation, electrical and piping connections, interlocks etc.
- c) SITC of 5 nos - complete functional centrifugal condenser water pumps, back pull type only including pump, electric motor, base frame, flexible spacer coupling, floating foundation, electrical and piping connections, interlocks etc.
- d) SITC of 2 nos- FRP cooling towers complete working units including fan, motor, fills, FRP panels, base frame, internal supports, foundation, piping, electricals etc.
- e) SITC of complete electrical panel including incomer ACB, ACB's for 2 nos - water chilling screw units, 10 nos - pump motor starter, 4 - cooling towers, spare switches, bus bar of suitable size, accessories, supply & making required connections etc.
- f) **The work also involves disconnection, dismantle, loading, unloading, shifting using crane etc. inside the IUAC site within 800 meters approx. distance, as per the instructions of Engineer In -Charge of following equipments / material :**
 - i. 4 no. - 101.4 TR complete chilling unit (without dismantling of compressor, motor, internal piping, condensor, evaporator, base frame etc.) foundation, cable from chilling unit to panel, control cables, gauge panel, piping connections etc.
 - ii. Condenser / chilled water piping – lot
 - iii. Existing 2 nos - Chilled water pumps, 5 nos – condenser water pumps at IUAC i.e. pump, motor, base frame, foundation, piping, electrical power, control wiring etc.
 - iv. Existing electrical panel, loading, unloading, shifting of same to the site within 800 meters distance.
 - v. Old pipes to the IUAC junk yard after cutting into pieces by gas cutting.

- vi. Existing butterfly, balancing, NRV valves of sizes 6" NB by loosening the nuts bolts without damaging the valves.
- vii. The malba of the R.C.C. foundation and removed insulation material shall be taken away outside IUAC campus & dumped at appropriate place designated by MCD / NDMC agency.

Please note that the bolts are badly rusted & while removing them all the care shall be taken to not to damage the adjacent equipments / valves / buildings etc.

Inlet and outlet ends of equipments and pipe shall be properly covered / blanked off, so that no material enters inside them.

The equipments shall be provided proper covering with suitable material whenever any work i.e. painting, insulation, welding etc. takes place near / over head the equipments. All care shall be taken such that there is no damage to existing equipments / building. In case of any damage, the bidder shall make right the same without any cost to IUAC.

The plant is under round the clock operation where the replacement of piping and chiller unit installation is planned. The work should be planned in such a way that the shut down time required is minimum and is in co-ordination with the IUAC Engineer in-charge.

Also any pipe cutting, fixing of temporary valves, blank off of pipe, temporary electrical cable and connection providing etc. to temporary isolate the system shall be included in the scope of work.

Disconnection, connection, blind Flanges, gaskets (by cutting, welding, bolting etc.) may have to be provided in piping to temporarily isolate the different sections of piping for part testing , isolating of system. Deemed to be included in the quoted price

After installation the water flow balancing shall be carried out by adjusting the balancing valve using manometer, which is to be arranged by contractor.

2.3 Test data

After supply, installation, testing & commissioning at site, the contractor shall give the Performance / cooling capacity test of the chilling units / pumps / electrical panel / system for it's rated parameters & test to be done for minimum of one week for each unit. The cooling capacity test shall be carried out in peak summer conditions if loads are not available. The complete test data shall be furnished on prescribed data sheet. All the arrangements for material / test instruments / modifications etc. shall made by bidder without any extra cost to IUAC.

2.4 Codes and Standards

All the design/material / workman ship / fabrication shall conform to the prevalent latest Indian / equivalent Foreign Standards, Local statutory rules, safety standards, Indian Electricity Act and Indian Electricity Rules as amended from time to time. In particular the equipment shall conform to following:

1. ANSI B9.1 Safety code for Mechanical Refrigeration
2. IS : 659 Safety code for air Conditioning.
3. IS : 660 Safety code for Mechanical Refrigeration.

2.5 Technical data, Makes of Equipments & Data Confirmation sheet

The contractor shall furnish complete Technical Data and Data sheet of the equipment offered by him as required under the heading Technical Data, Make of Equipments and Data Confirmation sheet respectively. Incomplete Data sheets may attract rejection of bid.

2.6 Equipment Selection

The selection of various equipment along with equipment data shall be sent for approval prior to ordering.

It is imperative that the selection of pumps sent for approval should include pump operating curves also.

2.7. Test Points

A test point shall be installed at the inlet and outlet of each pump and balancing valve and heat exchanging equipment like chiller, condenser, water cooling coil, AHUs etc.

The test point shall be of BSPT brass construction with neoprene sealing bushes and shall be provided with screwed cover.

3. Civil Works

The required civil works for erection of the Chilling Units, cooling towers, pumps are included in the scope of work and quoted rates to cover for the same.

4. STORAGE AND LIVING ACCOMMODATION

The contractor will be responsible for storage of equipment at site and necessary locking, safety and security arrangement will have to be made by the successful bidders at his cost. Safety of all the materials stored and responsibility of the same shall entirely be that of the bidders.

The IUAC does not provide any living accommodation.

5. TRAINING TO THE STAFF AND OPERATING INSTRUCTIONS

The Contractor shall train the person nominated by IUAC during the erection of the equipment at site free of cost to IUAC, regarding operation and maintenance of the various equipment being erected. The person shall be supplied with a set of necessary literature, operating instructions, wiring diagrams etc., so that at a later date he is able to attend to the minor faults and also maintain the equipment. 3 copies of operating instructions, literature, wiring diagram etc., bound in a book form shall also be supplied to IUAC after erection of the equipment.

6. Inspection

Material should be offered for inspection and testing at factory before dispatch to site where ever applicable.

7. DOCUMENTS TO BE FURNISHED BY VENDOR AFTER AWARD OF CONTRACT

7.1. Activity Bar Chart.

7.2. Technical details, Make & model of all the items (BOQ) offered to supply.

7.3 Drawings for Layout Plan for Chilling units, Cooling Towers, Chilled water Pumps, Piping, electrical panel.

7.4 Foundation detail drawing for Chilling unit. Cooling towers & pumps.

7.5 Schematic piping diagram.

7.6 Piping & supports drawing.

7.7 Manufacturer's material certificate, test reports & manuals should be submitted in original for equipment, pipes, fittings, insulation material, instrumentation, valves (balancing valve, butterfly valves, check valves etc.),

7.8 Performance / characteristic curves, material and test certificates, manuals for :

- i. Chilling Units.
- ii. Chilled / condenser water pumps.
- iii. Cooling towers
- iv. Balancing valves
- v. For any other supplies

7.9 General Arrangement Drawing, Power and Control Circuit Wiring diagram for electrical panel, electrical motor starters . 3 copies of as built blue prints and one copy on tracing sheet.

7.10 ARI / AHRI certification copy for chilling unit.

7.11 Any other documents required.

GENERAL:

Supply, erection, testing and commissioning of all the items / equipments will be to the best of industry workmanship and will include all the works and materials.

1 Water Cooled Rotary Screw water Chilling Units :

1.1 General: The microprocessor controlled water cooled rotary twin screw type water chilling unit shall be imported, packaged, factory assembled, tested, complete in all respects and shall generally comply with the specifications as given in subsequent paragraphs.

Each water cooled chilling unit shall be standard cooling model and comprise :

- i. Serviceable bolted semi hermetic, direct drive rotary twin screw compressor and motor.
- ii. Shell and Tube Condenser with accessories and supports.
- iii. Direct Expansion or Flooded, Shell and Tube type Chiller with accessories, supports and insulation.
- iv. Oil Recovery Unit.
- v. Steel structure as required for assembling/mounting the above, fully protected with a primary coating and finished with an acrylic paint.
- vi. Microprocessor based control panel with automatic controls and display module, compatible for BMS connectivity through BACNET or MODBUS or Ethernet.
- vii. Accessories as specified/required.
- viii. Interconnecting copper refrigerant piping.
- x. Full factory charged R-134a refrigerant and oil.
- xi. Factory insulated evaporator, chilled water interconnecting piping, motor, chilled parts etc.
- xii. Unit mounted MCCB & VFD Starter for the motor in each unit.

1.2 Compressor

- i. Each unit shall have direct drive, twin rotary screw, serviceable bolted semi hermetic sealed type compressor with internal muffler & check valve. It shall be using R134a refrigerant.
- ii. The twin rotary screw shall be manufactured from forged steel with precision cast and matched male/female profiles which are asymmetrical. The profile of screws shall permit safe design operation up to a speed of 5000 RPM for 50 Hz operation.
- iii. The compressor housing shall be of high grade cast iron, machined with precision, to provide a very close tolerance between the rotors and the housing.
- iv. The rotors shall be mounted on anti friction bearings designed to reduce friction and power input. There shall be multiple pressure lubricated cylindrical bearings to handle the radial and axial loads.

v. There shall be built in oil reservoir to ensure full supply of lubricants to all bearings and a check valve to prevent back spin during shut down.

vi. There shall be oil pump or other means of differential pressure inside the compressor for forced lubrication of all parts during startup, running and coasting for shut down. An oil sump header shall be provided in the casing.

vii. In case of constant speed, the compressor shall be complete with a hydraulically actuated slide valve positioned over both the male and female rotors pilot operated solenoid valve to provide an automatic step less, capacity control mechanism, to permit modulation between 20% to 100% of capacity range. Controls shall be provided for automatic shut down of unit, if capacity drops below 25%.

In case of variable frequency drive the capacity control shall be done by adjusting the rotation speed of the screws.

viii. IKW/TR (Input Kilo Watt / TR) at full load shall not exceed 0.67.

1.3 Compressor motor

i. The driving motor shall be double squirrel cage, two pole induction type, semi hermetic sealed, suction gas cooled, class 'F' insulation, totally enclosed, protected against damage by means of built in protection devices.

ii. It shall have synchronous speed of 3000 rpm.

iii. It shall operate on 415+- 10%, Volts, 3 Phase, 50 Hz alternating current.

iv. Motor shall have the minimum rated output to meet the requirement.

1.4 Water Cooled Condenser

Each unit shall have single circuit, horizontal shell and tube type, water cooled, multi pass condenser, fitted with safety valve, purge valve, and other safety devices. It shall be mechanically cleanable with removable heads.

1.4.1 Rating :

i) The condenser capacity shall match the compressor capacity as specified in tender. It shall be selected for 4.2 degree C temperature rise of water through the condenser.

ii) It shall be designed for fouling factor 0.001 (FPS units).

iii) It shall be designed for 32.2 Deg C entering water temperature.

1.4.2 Material and Construction :

i. It shall be horizontal, shell and tube type, designed, constructed and tested for refrigerant R134a.

ii. The shell shall be made of M.S. of thickness not less than 8 mm, with electric fusion welded seam. The shell capacity shall be such as to hold 1.25 times the refrigerant charge in the machine of which the condenser is a part, under pumped down conditions. It shall be welded steel construction fitted with machined steel tube sheets on either ends.

iii. The end plates shall be made of MS of thickness not less than 25 mm.

iv. The condenser shall designed for a working pressure on the refrigerant side suitable for R134a and water side for 10 kg/sq cm.

v. The tubes shall be of seamless hard drawn copper and integrally finned. The minimum wall thickness shall be 1 mm with root thickness of 0.63 mm below the fins and a

minimum dia. of 12 mm O.D. The tubes shall be suitably supported in the shell, to avoid noise and vibrations and the ends shall be properly expanded in the tube sheets to prevent leakage of refrigerant gas.

- vi. Intermediate tube supports of steel shall be provided at not more than 1250 mm intervals to prevent sagging and vibration of the tubes. It shall have water boxes for multi pass flow.
- vii. The tubes may be provided with the special tabulating arrangement to improve heat transfer where such an arrangement is a standard design of manufacturer.
- viii. It shall be provided with removable heads on either side made of cast iron or steel with neatly machined surface for effective jointing with the shell for easy accessibility for cleaning / replacement of the tubes. Suitable baffles shall be incorporated to achieve the required number of passes.
- ix. It shall be provided with the baffle arrangement for preventing direct impingement of hot gas over the tubes and to enable even distribution of the gas over the tube bundles.
- x. It shall include necessary provision for sub-cooling of the refrigerant where the machine is selected with such sub-cooling requirement. The arrangement shall be such that the cold water entering the condenser first cools the liquid refrigerant in the sub-cooler.
- xi. The condenser shall be sand blasted from both inside and outside.

1.4.3 Connections and accessories

The condenser shall be provided with the following connections and accessories and conforming to Section "Refrigerant piping" where applicable :

- a. Hot gas inlet and liquid outlet connections. The liquid line connection shall be provided with isolating valves.
- b. Water inlet and outlet flange connections.
- c. Pressure relief device.
- d. drain connection with valve for water side.

1.4.4 Pressure Testing :

- a) It shall be tested at the works at 15 kg / sq cm (pneumatic) for refrigerant side.
- b) The water side shall be hydro tested for a pressure of 10 kg / sq cm (150 psig).
- c) It shall be designed in accordance with ASME or other equivalent code for the refrigerant being used and otherwise tested and constructed in accordance with ASME or equivalent approved code requirements.

1.4.5 The condenser shall be complete in all respects.

1.5 Chiller (Evaporator)

Each unit shall have single circuit, horizontal shell and tube type, flooded / Direct expansion type, multi pass, fitted with safety valve, purge valve, and other safety devices. It shall be mechanically cleanable with removable heads.

1.5.1 Rating :

- i) The capacity shall match the compressor capacity as specified in tender. It shall be selected for 5.5 degree C temperature drop through it.
- ii) It shall be designed for fouling factor 0.0005 (FPS units).

1.5.2 Material and Construction :

- i. It shall be horizontal, shell and tube type, designed, constructed and tested for refrigerant R134a.
- ii. It shall be designed for a working pressure on the refrigerant side suitable for R134a and water side for 10 kg/sq cm.
- iii. The end plates shall be made of MS of thickness not less than 25 mm.
- iv. The shell shall be made of M.S. of thickness not less than 8 mm, with electric fusion welded seam. It shall be welded steel construction fitted with machined steel tube sheets on either ends.
- v. The tubes shall be of seamless hard drawn copper with the minimum tube wall thickness of 0.71 mm for plain tubes and minimum 0.63 mm at the root of the fins.
- vi. The tubes shall be internally plain, externally enhanced.
- vii. The tubes shall be rolled into grooves in the tube sheets and flared at ends.
- viii. Intermediate tube supports of steel or polypropylene shall be provided at not more than 1250 mm intervals to prevent sagging and vibration of the tubes.
- ix. It shall have water boxes for multi pass flow. It shall be provided with removable heads on either side made of cast iron or steel with neatly machined surface for effective jointing with the shell for easy accessibility for cleaning / replacement of the tubes. Suitable baffles shall be incorporated to achieve the required number of passes.
- x. It shall be smooth finished with one coat of zinc chromate primer before the insulation is applied
- xi. The evaporator shall be sand blasted from both inside and outside.

1.5.3 Connections and accessories

The chiller (flooded type) shall be provided with the following connections and accessories and conforming to Section “Refrigerant piping” where applicable :

- i. Refrigerant inlet and liquid outlet connections.
- ii. liquid refrigerant float for level control/expansion valve/ fixed or variable orifice.
- iii. Pressure relief device
- iv. Charging connection with valve.
- v. Eliminator plate.
- vi. Drain and vent connections with valve.
- vii. Water inlet and outlet flanged connections.
- viii. Proper oil return system.

1.5.4 Pressure Testing :

It shall be tested at the works at 15 kg / sq cm (pneumatic) for refrigerant side.

The water side shall be hydro tested for a pressure of 10 kg / sq cm (150 psig).

It shall be designed in accordance with ASME or other equivalent code for the refrigerant being used and otherwise tested and constructed in accordance with ASME or equivalent approved code requirements.

1.5.5 Insulation :

The chiller shall be insulated with minimum 25 mm thick factory installed closed cell insulation having k value of 0.037 W/mk at 20 deg C and minimum density of 55 kgs/cum.

1.5.6 The chiller shall be complete in all respects.

1.6 Capacity Control

- i. The unit shall be equipped with VFD drive and suitable devices for step less capacity control to unload compressor.
- ii. The device shall be capable of permitting stable operation in the range of 25% to 100% of rated capacity.

1.7. Oil Recovery Unit

An efficient oil separator shall be included to remove oil from the refrigerant and there shall be suitable heat exchanger for oil separation, if required. Compressor shall be fully field serviceable type. Discharge oil separation shall be accomplished, external to the compressor casing, oil separator and return system. Seal shall be designed to ensure that oil is adequately returned to the compressor and does not collect in the heat exchangers.

1.8 Refrigerant piping

The refrigerant piping between compressors, chiller and condenser shall be of heavy gauge copper with brazed joints. It shall have Suitable Solenoid Valves, Electronic Expansion Valves, Filters, Driers, liquid level Sight Glass, Moisture Indicator, Necessary Shut Off Valves, High & low side pressure relief devices. The pipe lines shall be insulated, as required.

1.9 Lubrication system

- i. The lubrication system shall be complete with accessories such as oil chiller with thermostatic control, oil heaters, oil strainer, relief valve etc.
- ii. Necessary pipe lines for lubricants and Cooling system with valves, should be included.

1.10 Type of Refrigerant

In view of Montreal convention units using R-134a refrigerant should be provided. It should be factory charged.

1.11 Starter for compressor motor

The starter for the motor shall be VFD unit mounted. MCCB with operating handle of suitable capacity shall be provided. The starter should be housed in a separate, unit mounted IP 54 housing and include all necessary safety devices i.e. Overload relays, single phase preventing device, timer, indications etc as required to fulfill all operational & safety requirements.

1.12 Control console

The unit shall be complete with a Microprocessor Based Interactive Control Console mounted directly on the unit, non - volatile memory and pre - wired with all operating and safety controls and LCD display. It shall include start-up and shut down capability, leaving chilled water control, compressor and electronic expansion valve modulation, anti-recycle logic, automatic lead/lag compressor starting and load limiting. Unit protective functions shall include loss of chilled water flow, evaporator freezing, loss of refrigerant, low and high refrigerant pressure, compressor starting and running over current, phase loss, phase unbalance, phase reversal and loss of oil flow.

Data in English language shall be clearly displayed on the door mounted panel, indicating chilled water set point, current limit set point, leaving chilled water temperature, evaporator and condenser refrigerant pressures and temperatures. All messages are to be displayed when a

problem is detected in any type of safety controls, like motor over loads, timers, motor winding temperature protectors, interlock mechanism, differential switches etc.

The chilling unit shall be complete with all controls.

I. The control console shall have the following extended capabilities :

a. Remote indication of

- Chiller operating status
- Shutdown codes
- Key operating parameters
- Self-diagnostics
- Chilled water reset

b. Programming capabilities of

- Leaving chilled water temperature
- Reset of chilled water temperature from :
- Return chilled water temperature (to maintain constant return chilled water temperature)
- Reset of supply water temperature.
- Load on chiller.

c. Power demand limit

d. Reset of power demand limit from :

- Stepped-position contact closure (80/60/40% select able)

e. Lead-lag operation of compressor in multi compressor unit and control.

ii. The control console should include but not be limited to the items listed below :

- Start/stop switch and micro processor module for capacity control system with overload limit control point adjustment, oil pump and purge unit controls etc.
- Indicating lights.
- Suction, oil and discharge pressure indications.
- Safety cutouts for low chilled water temperature, high oil temperature, low oil pressure, high and low refrigerant pressures with reset buttons.
- Necessary motor protection devices.
- Other time delays, relays, thermostat, temperature and pressure switches etc., as required.

1.13 Painting

Water Chilling machine shall be finished with durable enamel paint. Shop coats of paint that have become marred during shipment or erection, shall be cleared off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with enamel paint.

1.14 Miscellaneous (Priced separately in BOQ)

Each unit shall be provided with following items and as listed in schedule of prices.

- a) Water flow switches at the outlet of the condenser and the chiller.
- b) Stem type thermometers and dial type water pressure gauges at the inlet and outlet of the condenser and the chiller.

- c) Suitable size Manual Butterfly valves at the inlet & outlet of the condenser and chiller, as given in Schedule Of Prices.
- d) Suitable size balancing valve at the Outlet of condenser and chiller
- e) Automatic Air Vents at the Inlet and Outlet of chiller.
- f) Pressure relief valves at the water pipe line.

Each unit shall include, but not be limited to, all the items listed in the foregoing paragraphs or in the schedule of quantity. In addition all such items, as may be required, shall be included whether specifically mentioned or not, if considered or found necessary to fulfill the intent and meaning for the purpose of maintaining design operations under all extreme weather conditions .

1.15 Limitations

- a) The fouling factor for condenser shall be 0.001 (FPS units).
- b) The fouling factor for chiller shall be 0.0005 (FPS units).
- c) The Water velocity in the condenser and the chiller shall not exceed 3.05 m/sec. (10 FPS).

1.16 Installation and testing

- a) The complete water chilling unit shall be mounted on a suitable 1” thick rubber isolation pads on leveled R.C.C. Foundation.
- b) **R.C.C. Foundation** : R.C.C. foundation of two slabs shall be of size (LxWxH) mm 1600 x 900 x 250 or as per manufacturer's drawing, for each chilling unit. It should be made of all around frame of M.S. equal angle 50 x 50 x 6 mm, steel reinforcement grid of 100 mm max. made of steel bar-8 mm, cement: sand : concrete moisture of 1:1.5:3 to be made on existing floor after chipping, exposing & welding with the old reinforcement. M.S. Plate of dimension as per the foot prints of chiller legs and 12 mm thick shall be grouted and leveled.
- c) All controls and switch gear shall be tested for proper functioning and as per design values.
- d) The contractor must perform all inspection and tests of the system as required, under the supervision of the engineer in charge, in accordance with the provisions of the applicable ASHRAE standards or approved equal in addition to furnish necessary test certificates from manufacturers.
- e) The system shall then be commissioned, tested and balanced to fulfill the intent and purpose for which it is designed.
- f) In addition continuous Run Tests shall be carried out during peak weather condition for one week.
- g) All instruments and personnel for tests shall be provided by the contractor.

1.17 Performance Rating & Testing

The unit shall be selected for the lowest operating noise level. Computerized selection giving details of capacity ratings and power consumption with operating points clearly indicated, shall be submitted and verified at the time of testing and commissioning of the installation. On completion of installation and static tests the Water Chilling unit shall be tested for performance. The capacity in kcal/hr. (tons) shall be calculated from measurements of temperature difference

and flow rate of water in condenser and chilled water in chiller using the balancing valves. The power consumption shall be checked from current measurement of the motor. All calculated and checked results shall match the specified data.

The unit shall also be tested at field for designed noise and vibration levels.

1.18 Power consumption

Power consumption shall be computed from measurements of incoming voltage & input current. The Full load (100%) IKW/TR should be less than 0.67 kW/Ton at operating conditions.

1.19 ARI Certification

The chilling units shall be certified in accordance with ARI 550/590-1992 (Updated 1998). All suppliers shall furnish computer printouts giving details of capacity output power consumption etc. at site conditions as specified at the time of submission of tender bids.

Data Sheet-1 (Water Cooled Screw Type Water Chilling Unit)		
1	General data	
1.1.1	Designation	Ch-1&2
1.1.2	Service	Chilled Water
1.1.3	Type	Twin Screw Semi Hermetic sealed
1.1.4	Quantity Required	2
1.1.5	Capacity (each)	250 TR at operating conditions.
1.1.6	Refrigerant	R134a
1.1.7	Expansion Device	Float valve/ Electronic Expansion Valve
1.1.8	Input Kilo Watt / TR at Full load	lkW/Ton <0.67
1.1.9	Vibration Isolators	1" Thick Neoprene Rubber pads with sole plates for leveling
1.1.1	Foundation (Item rate quoted)	Bidder's Scope
1.2	Operating Conditions	
1.2.1	Chilled water outlet temperature	6.67 ° C
1.2.2	Chilled water Inlet Temp.	12.2 ° C
1.2.3	Condenser Water Inlet Temp.	32.2 ° C
1.2.4	Condenser Water Outlet Temp.	36.4 ° C
1.2.5	Condenser Cooling water Flow (each)	as per design
1.2.6	Chiller Cooling water Flow (each)	as required
1.2.7	Fouling Factor for chiller	0.0005 (FPS)
1.2.8	Fouling Factor for condenser	0.001 (FPS)
1.3	Screw Compressor	
1.3.1	Type	Twin Screw
1.3.2	No of compressors per unit	single
1.3.3	No of Stages	One
1.3.4	Drive	Direct
1.3.5	Lubrication	Forced / differential
1.3.6	Capacity Control	Automatic Step less, 20% - 100%
1.4	Drive / Compressor Motor	
1.4.1	Type Drive	Direct Drive
1.4.2	Type motor	Manufacturer's Standard
1.4.3	Type of starter (Unit mounted)	VFD
1.4.4	Rating	kW suitable capacity
1.4.5	Electric Supply	Volts 415

1.4.6	No. of phases	Nos.	3
1.4.7	Frequency	Hz	50
1.4.8	Starting current not to exceed		2.5 times the running current
1.4.9	Insulation class		F
1.5	Condenser and Chiller		Bidder's scope
1.5.1	Type		Shell & tube
1.5.2	Material of Shell		M.S.
1.5.3	Material of tubes		Copper (seamless)
1.5.4	Type of chiller		Flooded / Direct Expansion
1.5.5	Type of condenser		Water cooled
1.5.6	Water Pressure drop in condenser		Not exceeding 7 mWC
1.5.7	Water Pressure drop in Chiller		Not exceeding 7 mWC
1.5.8	Design Code		ASME / equivalent
1.6	Control Panel & features		As per technical details
1.7	Operating Safety interlock & Feature		As per technical details
1.8	Chiller Insulation of shall be factory insulated		Nitrile Rubber Foam, thick-1", density-68 kg/cum with 3 mm thick PVC covering as vapour barrier.
1.9	Please read the technical details & specifications for complete details.		
1.10	Unit Certification		ARI 550/590-1992

Technical Data - TO BE SUBMITTED BY BIDDER WITH TECHNICAL BID		
	Item (Bidder's Scope & deemed to include in quoted price)	To be filled by Bidder
1	Water Cooled Screw type Water chilling unit :	
1.1.1	Manufacturer, Make	
1.1.2	Model	
1.1.3	Country of origin (Imported)	
1.1.4	Quantity Nos. offered	2
1.1.5	Type	Screw
1.1.6	Refrigerant Used	134a
1.1.7	Nos of Compressors in per unit – Single	Confirm
1.1.8	Power Input Chiller IKW at full load operating conditions	
1.1.9	Part Load Value at operating conditions at 100%, 75%, 50%, 25% in kW	
1.1.10	NPLV at operating conditions IkW/Ton	
1.1.11	Full Load (100%) at operating conditions IkW/Ton	
1.1.12	EER (BTU/WATT)	
1.1.13	Max. Capacity of Units (state Operating Conditions, water quantities / temperatures, pressure drops etc.)	
1.1.14	Vibration Isolators, 1" thick, Included	Confirm
1.1.15	R.C.C. Foundation	Confirm
1.1.16	Overall Dimensions L x W x H (mm)	
1.1.17	Foot Print Dimensions L x W x H (mm)	
1.1.18	Operating weight Kgs	
1.1.19	Vibration Level at operating Speed	
1.1.20	Noise Level dB	
1.1.21	AHRI/ARI Certification	Confirm
1.1.22	Isolating valves on suction / Discharge of compressors (if multiple compressors)	NA
1.1.23	Full Factory charge of R-134a refrigerant and oil	Confirm
1.1.24	Unit mounted Suitable MCCB & VFD for compressor motor.	Confirm
1.1.25	Starter Rating Amps	
1.1.26	MCCB Switch Rating Amps	
1.1.27	Rating of ACB Provided (Item rate quoted) Amps	
1.1.28	Single point electrical connection	Confirm
1.2	Screw Compressor	
1.2.1	Suction Temperature °C	
1.2.2	Condensing Temperature °C	
1.2.3	Operating speed rpm	
1.2.4	Type of drive and speed ratio	

1.2.5	Capacity of Chiller at operating conditions (Normal) Kcal/hour (TR)	
1.2.6	Total Power Consumed at operating conditions as above kW	
1.2.7	Semi hermetic sealed, Rotary twin screw	Confirm
1.2.8	Pressure lubricated cylindrical bearings for the radial and axial loads.	Confirm
1.2.9	Oil reservoir, a check valve	Confirm
1.2.10	Oil pump or other means of differential pressure for forced lubrication	Confirm
1.2.11	Oil Recovery system	
1.2.12	Controls for automatic shut down of unit, if capacity drops below 20%.	Confirm
1.2.13	Type of capacity control	
1.2.14	Capacity control range	
1.3	<u>Drive / Compressor Motor</u>	
1.3.1	Type drive	
1.3.2	Type motor	
1.3.4	Rate output kW	
1.3.5	Working voltage range Volts	
1.3.6	No. of phases Nos.	
1.3.7	Frequency Hz	
1.3.8	RPM nos	
1.3.9	Running Current AMPS	
1.3.10	Max. Starting Current AMPS	
1.3.11	LRA/FLA AMPS	
1.3.12	Insulation class	
1.3.13	Weather protection	
1.3.14	Type of Enclosure	
1.3.15	Efficiency	
1.3.16	Power factor	
1.3.17	Temperature rise over ambient of 45 deg C	
1.3.18	Load Versus Torque Characteristics	
1.4	Capacity Control	
1.4.1	Type step less	Confirm
1.4.2	Capacity control Range	
1.5	Oil Recovery Unit	
1.5.1	Oil Heat exchanger	Confirm
1.5.2	Suitable Solenoid Valves	Confirm
1.5.3	Electronic Expansion Valves	Confirm

1.5.4	Filter Driers	Confirm
1.5.5	Sight Glass	Confirm
1.5.6	Moisture Indicator	Confirm
1.6	Refrigerant piping	Confirm
1.6.1	Shut Off Valves	Confirm
1.6.2	Insulation provided	Confirm
1.7	Lubrication system	
1.7.1	Oil chiller	Confirm
1.7.2	Thermostatic control	Confirm
1.7.3	Oil heaters	Confirm
1.7.4	Oil strainer	Confirm
1.7.5	Relief valve	Confirm
1.7.6	Shut off valve	Confirm
1.8	Electric Starter for compressor motor	
1.8.1	Unit mounted automatic VFD	Confirm
1.8.2	starting current, within 2.5 times the full load current.	Confirm
1.8.3	Overload current, Under voltage, Single phase / phase reversal prevention protections	Confirm
1.8.4	MCCB Switch	Confirm
1.9	Control console controls :	
	Microprocessor Based Interactive Control Console mounted on the unit	Confirm
	Start / Stop switch	Confirm
	leaving chilled water control	Confirm
	compressor and electronic expansion valve modulation	Confirm
	automatic lead/lag compressor starting	Confirm
	anti-recycle logic	Confirm
	load limiting	Confirm
	oil pump and purge unit controls	Confirm
1.9.1	Indicating lights.	Confirm
	Suction, oil and discharge pressure indications.	Confirm
	time delays	Confirm
	temperature and pressure switches	Confirm
	current limit set point	
	evaporator and condenser refrigerant pressures and temperatures	
1.9.2	Safety Cut outs :	
	loss of chilled water flow	Confirm
	loss of condenser water flow	Confirm

	low chilled water temperature		Confirm
	evaporator freezing		Confirm
	loss of refrigerant		Confirm
	low and high refrigerant pressure		Confirm
	compressor starting and running over current		Confirm
	phase loss		Confirm
	phase unbalance		Confirm
	phase reversal		Confirm
	motor over loads		Confirm
	motor winding temperature protectors		Confirm
	interlock mechanism		Confirm
	differential switches		Confirm
	timers		Confirm
	loss of oil flow / low oil pressure.		Confirm
	high oil temperature		Confirm
1.9.3	Programming capabilities of		
	-Leaving chilled water temperature		Confirm
	-Reset of chilled water temperature from :		Confirm
	-Return chilled water temperature (to maintain constant return chilled water temperature)		Confirm
	-Reset of supply water temperature.		Confirm
	-Load on chiller.		Confirm
	-Power demand limit		Confirm
	-Reset of power demand limit from :		Confirm
	-Stepped-position contact closure (80/60/40% selectable)		Confirm
1.10	<u>Water Cooled Refrigerant Condenser</u>		
1.10.1	Type		
1.4.2	Model / Size		
1.10.3	Total Heat Transfer Area :		
1.10.4	Refrigerant side	M ²	
1.10.5	Water Side	M ²	
1.4.6	Water Inlet / outlet temperature	°C	
1.10.7	Water flow rate (Design)	CMH	
1.10.8	Water Velocities of tubes	m/s	
1.10.9	Water Pressure drop	mWC	
1.10.10	Fouling Factor	(FPS)	
1.10.11	No. in each unit		
1.10.12	No. of Circuits (in case of multiple compressor)		NA
1.10.13	No. of Passes		

1.10.14	Safety Valve		Confirm
1.10.15	Purge Valve		Confirm
1.10.16	Tubes finned		Confirm
1.4.17	Tube Size & Thickness	mm	
1.10.18	Water In / Out Flange End Connections		Confirm
1.4.19	Support for mounting.		Confirm
1.10.20	Refrigerant In and Out connections.		Confirm
1.4.21	Liquid Line Valve, Drain connection with valve.		Confirm
1.10.22	Design Code		ASME / Equiv.
1.10	Refrigerant Chiller		
1.10.1	Type - Direct Expansion or Flooded type cooler		
1.5.2	Model / Size		
1.10.3	No. of circuits (in case of multiple compressors)		NA
1.5.4	No. of passes		
1.10.5	Capacity	Ton	
1.10.6	Total Heat Transfer Area :		
1.10.7	Refrigerant side	M ²	
1.10.8	Water Side	M ²	
1.10.9	water Inlet / outlet temperature	°C	
1.10.10	Chilled Water flow rate (Design)	CMH	
1.10.11	Chilled Water flow rate (Max.)	CMH	
1.10.12	Chilled Water flow rate (Min.)	CMH	
1.10.13	Water Velocities of tubes	m/s	
1.10.14	Water Pressure drop	mWC	
1.10.15	Fouling Factor	FPS	
1.10.16	Refrigerant Evaporating Temperature	°C	
1.10.17	Shell and tube Type		Confirm
1.10.18	Tubes seamless copper, finned		Confirm
1.10.19	Tube dia and thickness	mm	
1.10.20	Design code		ASME or equiv.
1.10.21	Insulation 25 mm thick (Factory Installed) with 3 mm PVC sheet for vapour barrier pasted with adhesive wrapped all over insulation.		Confirm
1.10.22	Flange end water in / out connections		Confirm
1.10.23	Drain Connection with valve		Confirm

2. Chilled /Condenser Water Horizontal Centrifugal Pumps:

2.1 General :

It should be complete functional unit including centrifugal pump, electric motor, flexible spacer coupling, base frame, foundation (motor starter, piping & valves – item rate quoted in BOQ).

2.2 Design :

- a) The pump shall be centrifugal, back pull type, direct driven with 3 phase, 415 volts \pm 10 % volts, 50 Hz, A.C.Motor.
- b) It should be solid casing type with 1440 RPM operating speed and for continuous operation.
- c) It shall be of high efficiency.
- d) It should be with end suction and top discharge.
- e) It should be capable of developing the required total head at at rated capacity.
- f) The pump shall operate satisfactorily at any point on the H-Q characteristic curve over a range of 50% to 130% capacity or capacity corresponding to 75% of the total head which ever is low.
- g) Efficiency shall not less be than 65 %. The total head capacity curve preferably shall be continuously rising towards the shut off.
- h) Pumps shall run smooth without undue noise and vibration.
- i) The velocity of vibration shall be within 1.5 mm / sec.
- j) The noise level shall be limited to 65 dBA at 1.8m distance.

2.3 Constructional Features :

- a) The pump shall conform to IS 1620.
- b) The motor shall be SPDP fan cooled.
- c) The pump casing shall be high density cast iron or of cast steel volute machined to a close tolerance.
- d) The casing shall be provided with air release cock, drain plug & shaft seal arrangement as well as flanges for suction & delivery pipe connections as required.
- e) The casing should withstand working pressure upto 12 Kg/cm². The inside surfaces shall be given an anti corrosive coating.
- f) The impeller shall be of Bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller.
- g) The impeller surface shall be smooth finished for minimum frictional loss.
- h) The impeller shall be secured to the shaft by a key & nut. It should be properly balanced.
- i) It shall allow servicing of the impeller and bearing without disturbing the piping.
- j) The shaft shall be of stainless steel and accurately machined . The shaft should be balanced to avoid vibrations at any speed within operating range.
- k) The shaft sleeve shall be made of bronze / gunmetal. This shall extend over the full length of the stuffing box or seal housing. The sleeve shall be machined all over and ground on the outside.
- l) The bearings shall be ball or roller type suitable for the duty involved. These shall be grease / oil lubricated and shall be provided with grease nipples / cups. The bearings shall be effectively sealed against leakage of lubricant.
- m) The shafts seal shall be mechanical seal type with no water leak.

2.4 Installation :

- a) The pump and motor shall be mounted on a common frame, fabricated from MS C-channel of 125 mm x 6 mm thick minimum fabricated steel. The single base plate

- (grinding finish), 12 mm thick, shall have rigid, flat & true surfaces, each for the pump and motor mounting feet. It shall have necessary holes for grouting to the foundation.
- b) A suitable flexible coupling with spacer shall be provided to connect the pump and the motor. The both should be aligned to accuracy of 0.05 mm on radial and axial direction. Pump shall be leveled to 0.02 mm / meter with precision spirit level.
 - c) The S.S. Shims of required thickness shall be provided underneath the legs of motor and pump legs for alignment if required.
 - d) Coupling guard, made of expanded metal and bolted to the base plate shall be furnished for coupling.
 - e) The motor and starter (price quoted in electric panel) shall conform to relevant specifications and of ratings given elsewhere.
 - f) Thermal Insulation of chilled water pump shall be of same type & thickness as provided for connected pipes.

2.5 Foundation :

Only one Pump and motor assembly to be installed on each inertia block. The total weights of pump and inertia block shall be twice to thrice the weights of the pump/motor/base plate. The inertia solid block of minimum Size of extending 150 mm all around the base frame, suitable height (minimum 250 mm) with all around frame of M.S. equal angle 50 x 50 x 6 mm, steel reinforcement grid of 100 mm max. made of steel bar 8 mm dia, cement : sand : concrete mixture of 1:1.5:3 to be made. The inertia block shall be floating on vibration pads of 150 x 150 x 12 mm - 4 nos each placed at total 12 places.

2.6 Performance Tests

- I) The pump shall be tested as per IS:5120 at rated speed in manufacturer's place to measure capacity, total head, efficiency, and power.
- II) Test certificate for same to be supplied.

2.7 Field testing

After installation the pump shall be subjected to testing at field for designed noise and vibration levels.

2.8 Name plate

It should be mounted having details

- i. Design capacity
- ii. Total head
- iii. Speed
- iv. Sr. No.
- v. Model No.

TECHNICAL DATA -2
TO BE SUBMITTED BY BIDDER WITH TECHNICAL BID

	Item (Bidder's Scope in quoted price)	To be filled by Bidder
2.	Centrifugal Pumps (Chilled Water)	
2.1	Make	
2.2	Model	
2.3	Quantity nos.	2
2.4	Type - Back pullout	confirm
2.5	Suction - End	confirm
2.6	Discharge - Top	confirm
2.7	Design Flow rate – 150CMH approx / as required	
2.8	Total Head - 45 M approx. or as required.	
2.9	Shut off Head M	
2.10	Pump efficiency at duty point(> 65%)	
2.11	Power input to pump at duty point	
2.12	Motor, Squirrel Cage, induction motors, continuous duty, Star-Delta starter, Insulation Class-F, IP-55, Motor rating (415Volts/3-Phase/50Hz) kW	
2.13	Speed - 1440 RPM	
2.14	Type of motor enclosure SPDP	
2.15	Motor / Pump common Base Frame - C-channel, Size- 5” min, thick-6mm, with M.S Plates (grinding finish) with holes for motor / pump foots (Included) duly painted	Confirm
2.16	R.C.C. Floating Foundation included in scope duly painted	confirm
2.17	Flexible Coupling with spacer	confirm
2.18	Motor Starter – Star Delta Type, (included in electrical panel)	Confirm
2.19	Pump / motor compatible with VFD	Confirm
DATA TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT		
1	Final Overall dimensional drawings for pump set. These shall show all the major parameters of set.	
2	Cross sectional drawing of the pump indicating material of construction of all the parts.	
3	Foundation drawing indication details of fixing, grouting, total weight, plinth size, anchor bolts etc.	
4	Performance curve	
5	Test certificates	
6	Operation and maintenance manual.	

TECHNICAL DATA -3
TO BE SUBMITTED BY BIDDER WITH TECHNICAL BID

	Item (Bidder's Scope & deemed to include in quoted price)	To be filled by Bidder
3	Centrifugal Pumps (Condenser Water)	
3.1	Make	
3.2	Model	
3.3	Quantity – 3 + 2 nos.	
3.4	Type - Back pullout	confirm
3.5	Suction - End	confirm
3.6	Discharge - Top	confirm
3.7	Design Flow rate- 3 no.- 240 CMH , 2 no.- 190 CMH approx.	----- - 3 nos, ----- 2 nos
3.8	Total Head - 25 MWC approx. or as required	
3.9	Shut off Head M	
3.1	Pump efficiency at duty point (> 65%)	
3.11	Power input to pump at duty point	
3.12	Motor, Squirrel Cage, induction motors, continuous duty, Star-Delta starter, Insulation Class-F, Protection-IP-55, Motor rating (415Volts/3-Phase/50Hz) kW	
3.13	Speed -1440 RPM	
3.14	Type of motor enclosure -SPDP	
3.15	Insulation Class - F	
3.16	Motor / Pump common Base Frame - C-channel, Size- 5” min, thick-6mm, with M.S Plates (grinding finish) with holes for motor / pump feet. (included in scope) duly painted	Confirm
3.17	R.C.C. Floating Foundation included in scope duly painted	confirm
3.18	Flexible Coupling with spacer	confirm
3.19	Motor Starter - Star-Delta type (included in electrical panel)	Confirm
3.2	Pump / motor compatible with VFD	Confirm
DATA TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT.		
1	Final Overall dimensional drawings for pump set. These shall show all the major parameters of the pump set.	
2	Cross sectional drawing of the pump indicating material of construction of all the parts.	
3	Foundation drawing	
4	Performance curve	
5	Test certificates	
6	Operation and maintenance manual.	

Technical Data - 4		
<u>TO BE SUBMITTED BY BIDDER WITH TECHNICAL BID</u>		
	<u>Item (Bidder's Scope & deemed to include in quoted price)</u>	<u>To be filled by Bidder</u>
4	INDUCED DRAFT FRP COOLING TOWER	
4.1.1	Make	
4.1.2	Model	
4.1.3	Qty	2 nos
4.1.4	Total Design / Working Flow Capacity	275 CMH or as required
4.1.5	Overall Size of Tower (Maximum) (Both Tower shall fit in the area designated in 4.1.6.)	
4.1.6	Site Dimensions where cooling Tower will be installed. LxW mm	12000 x 6000
4.1.7	Hot Water Inlet Temperature °C	36.38
4.1.8	Design Ambient WBT °C	28.33
4.1.9	Recooled Water Temperature °C	32.2
4.1.10	Design Approach °C	3.9
4.1.11	Wind Velocity For Performance KMPH	STILL Air
4.1.12	Wind Velocity For Tower Structural Design KMPH	120
4.1.13	Tower Operation	Continuous
4.1.14	Duration of Operation	Continuous, 24 hrs / day.
4.1.15	Live Load for Fan Deck	
4.1.16	Type of Fluid, Flow	Water, Cross / Counter
4.1.17	Nature of Liquid	Neutral
4.1.18	Number of Cells	Single / multiple
4.2	<u>FEATURES OF CONSTRUCTION</u>	
4.2.1	Tower	
4.2.2	Type of Tower	Induced Draft FRP
4.2.3	Type of Air Inlet	From sides
4.2.4	Basin Type	Basin > 300 mm height
4.2.5	Make up, Quick Fill & Overflow Connection	Not Required.
4.2.6	Drain connection with valve	Yes.
4.3	<u>MATERIAL OF CONSTRUCTION</u>	
4.3.1	Casing	FRP

4.3.2	Inlet Louvers	FRP	
4.3.3	Fill	PVC (Fire Retardant)	
4.3.4	Fill Support	HDGMS	
4.3.5	Internal Supporting Structure (Please mention type / size / details of support structure)	HDGMS	
4.3.6	Water Distribution System	PVC	
4.3.7	Drift Eliminator and it's support	PVC	
4.3.8	Recovery Stack		
4.3.9	Orifices / Nozzles	PVC	
4.3.10	Fan Blade	Aluminium Alloy / FRP	
4.3.11	Fan Hub	S.S., Taper Bush fitting	
4.3.12	Fan Deck	*	
4.3.13	Hardware above Fan Deck	Hot Dip Galvanised Steel	
4.3.14	Hardware Below Fan Deck	*	
4.3.15	Drive Shaft	Direct Drive/ reduction gearbox.	
4.3.16	Basin	FRP	
4.3.17	Basin Supporting Structure	Hot Dip Galvanised Steel	
4.3.18	Access Ladder	Hot Dip Galvanised Steel	
4.3.19	Fan Guards	Hot Dip Galvanised Steel	
4.3.20	Hand Rail	Hot Dip Galvanised Steel	
4.3.21	Motor Casing	Hot Dip Galvanised Steel	
4.3.22	Fasteners	S.S.304/316	
4.4	<u>TESTS AND INSPECTION</u>		
4.4.1	Performance Test	Witnessed	
4.4.2	Test Location	Site	
4.4.3	Visual Inspection	Required	
4.4.4	Test Certificates for Fan	Required	
4.4.5	Test Certificates for Motor	Required	
4.5	Bidder's Scope of Supply		
4.5.1	No. of Cooling Towers	2	
4.5.2	Erection Included	Yes	
4.5.3	Supervision Included	Yes	
4.5.4	Base / FRP Basin support Frame	Yes	
4.5.5	R.C.C. Foundation Construction Included	Yes (Item rate in BOQ)	
4.5.6	Temperature Gauge at Inlet / Outlet	Yes (Item rate in BOQ)	
4.5.7	Access Ladder	Yes	

4.5.8	Hand Rail	Yes	
4.5.9	Fan Guard	Yes	
4.5.10	Fan Speed Variators	No	
4.5.11	Vibration Limit Switch	No	
4.5.12	Vibration Isolators	Yes	
4.5.13	Float switches	No	
4.5.14	Motor, Squirrel Cage, induction motors, continuous duty, Insulation Class-F, Protection-IP-55, 415Volts / 3-Phase / 50Hz) kW	Vendor	
4.5.15	Motor Starter	DOL (in Electrical Panel)	
4.5.16	MCB to Isolate Fan Motor Power Locally with weather proof PVC Enclosure	Yes (Item rate)	
4.5.17	Remote push button on/off switch near Cooling Tower in Weather proof PVC box..	Yes. (Item rate)	
4.6.1	General Arrangement Drawings of Cooling Tower showing Details of Tower and piping Arrangement.		
4.6.1	Thermal Performance Curves		
4.6.2	Fan Characteristic curves		
4.7	DATA TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT.		
4.7.1	Dimensional outline drawing of cooling tower with Plan, Elevation & Cross-Section		
4.7.2	Sectional Arrangement of the Basin showing details of all piping and fixing arrangement.		
4.7.3	Foundation and structural Details Drawing.		
4.7.4	Fan Performance Curve for capacity vs power, static head,efficiency, and blade pitch.		
4.7.5	Thermal Performance Curve.		
4.7.6	Electrical wiring and drive arrangement drawing.		
4.7.7	Operation and Maintenance Manuals.		

4. MS Piping & Fittings:

4.1 Pipe :

The M.S. pipes shall be ERW Black (≤ 150 mm shall be as per IS 1239, PTI, Heavy Class and ≥ 200 mm as per IS - 3589, 6 mm thick), beveled ends.

4.2 Flanges :

M.S.Flanges, SORF, ANSI B16.5, 150 lb.

Flanges may be tack welded into position, but all final welding shall be done with joints dismounted. 3 mm thick gaskets shall be used with all flanged joints. The gaskets shall be fiber reinforced rubber as approved by the Engineer-In-Charge.

Counter flanges for equipment having flange connections shall be used & provided by successful bidder.

Flange pairs shall be used on all such equipment, which may require to be isolated or removed for service e.g. Pumps, refrigeration machines etc.

All threaded valves shall be provided with nipples and flange pairs on both sides to permit flange connections, for removal of valves from main lines for repair/replacement.

4.3 Fittings : All fittings should confirm to ASTM A234, GR WPB, Sch.40, ANSI B 16.9. All integral branch off shall be stub connected. All fittings shall be tested to a pressure of 15 KSC.

4.4 Bolts : All bolts shall be as per IS:1367 CL 4.6 with dimensional standard as per IS:1364 and length to suit.

4.5 Nuts: All nuts shall be as per IS:1367 CL 4.0 with dimensional standard as per IS:1364 and Hexagonal.

4.6 Gaskets: All gaskets shall be as per CAF IS:2712 GRW/3 with dimensional standard of ANSI B 16.21 150# and 3 mm thick Ring Type.

4.7 Welding : Welding operations shall confirm to Chapter V of the code of Refinery piping ANSI B31.3 - latest edition.

All pipe ends shall be prepared V-end & tac welded before final welding.

The welder will be pre-qualified by us based on the 180 degree face and 180 deg root bend test of the samples to be test welded by him in our presence and in 45 degree position and the test result will be furnished by you from a govt approved test house. All expenditure to be incurred on the pre-qualification of the welder will be born by you including the cost of samples and arrangements made thereof. **Welding work will be allowed only after completion of welder test and submission of test report.**

Welders and welding procedures shall be certified as per section IX of ASME Boiler and pressure vessel code - latest edition.

The electric current for welding will be DC straight polarity (electrode negative).

All pipes shall be butt welded as per ANSI B16.25.

The welding electrode to be used will be only **Advani/ IOL.**

4.8 Testing Piping : In general, tests shall be applied to piping before connection of equipment and appliances. In no case shall the piping, equipment or appliances be subjected to pressures exceeding their test ratings.

The tests shall be completed and approved before any insulation is applied. Testing of segments of pipe work will be permitted, provided all open ends are first closed, by blank offs or flanges.

After tests have been completed the system shall be drained and flushed 3 to 4 times and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fillings and debris.

All piping shall be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 kg/cm² for a period of not less than 12 hours. All leaks and defects in the joints revealed during the testing shall be rectified to the satisfaction of the Engineer-In-Charge, without any extra cost.

All the piping systems shall be tested in the presence of the Engineer-In-Charge or their authorized representative. Advance notice of test dates shall be given and all equipments, labor, materials required for inspection, and repairs during the test shall be provided by the contractor. A test shall be repeated till the entire systems are found to be satisfactory to the above authority. The tests shall be carried out for a part of work if required by Engineer-In-Charge in order to avoid hindrance in the work of the insulation contractor.

Miscellaneous piping, tests with air at 10.5 kg/cm² without drop in pressure. for a minimum of 24 hours.

The contractor shall make sure that proper noiseless circulation is achieved through all piping systems. If due to poor bond, proper circulation is not achieved, the contractor shall bear all expenses for carrying out the rectification work including finishing of floors, walls and ceiling damaged in the process of rectifications.

The contractor shall provide all labour and materials to make provision for removing water and throwing it at the proper place, during the testing or/and after the testing to avoid damages to employer or other contractors' properties. Any damages caused by the contractor to the employer or other contractors properties, shall be borne by the contractor.

4.9 Pipe Supports : it should be made of structural steel & include G.I. clamps, anchor fasteners, wooden blocks, insulation pad. Supports will be installed at no larger than 3 meters and as per the design calculations to be furnished by you and consisting of C-channels, Angles, I section etc. of 6 mm minimum thickness. Extra support should be provided at bends & fittings like valves to avoid undue stress at pipes. The support columns have to be appropriately grouted using 1:2:4 concrete mix. The fabrication of hangers, anchors and materials shall conform to the requirements of chapter " Fabrication of pipe hangers, supports, anchors, Sway bracing and piping B31.3-latest issue.

4.10 Butterfly valve :

- Duty : Chilled Water / HOT Water / Condenser Water
- Pressure Rating : Confirm to BS:5155 PN-10/PN-16 & API-609 (As specified in BOQ)
- pH Value : Between 4 and 10
- Single body caste, Slim seal, wafer type,
- Body construction material should be graded cast iron

- Disc. Construction material should be Stainless steel.
- Disc. Seat should be an integral liner made of EDPM / Nitrite rubber, tight shut-off design
- Provide Hand Lever operated valves with locking arrangement for every 10° turn for valves up to NB200mm.
- Valves more than NB 350 mm shall allow for seat replacement at site.

4.11 Balancing Valves:

- Duty : Chilled Water / HOT Water / Condenser Water
- Pressure Rating : PN-10/PN-16 (As specified in B.O.Q.)
- pH Value :Between 4 and 10
- **Material Specification**
- Hand Wheel – CI-220
- Body / Bonnet –C.A. F. (CI 260 GG 25)
- Body / Bonnet Bolts –A 307, GR.B
- Gland Packing –Graphite asbestos
- Stem Seal –EPDM
- Stem –SS 410
- Disc. – SS 410
- Seat Seal –EPDM (Site replaceable)
- Tight Shut Off Type
- Flanges drilled to IS 6392 (PN 16) Standards
- The spindle shall be non-rising type, and its movement should be lockable/tamper proof type.
- Micro-meter scale in the wheel should allow fine settings up to 1/10th of a hand wheel turn. The spindle should be lockable with a lock screw, allowing the limiting maximum opening of valve, to pre – determined position, while still allowing to use as shut-off valve.
- T.A.B. (Testing, Adjusting and Balancing)
- Measurement of pressure drops and flow rate should be possible using the body taps and quarter turn cocks.
- Digital measurements compatibility is a pre – requisite.
- Published ‘K’ factor of valve for different hand wheel turns should be available.

4.12 DUAL PLATE CHECK VALVE

- Duty : Chilled Water / HOT Water / Condenser Water
- Pressure Rating :Confirm to BS:5155 PN-10/PN-16 & API-609
- pH Value :Between 4 and 10
- **Material Specification**
- Dual plate with independent springs in a central hinge pin, to allow for reduced hammer and non-slam
- Valve design should confirm to APS-594 and API-6D
- One piece body, cast cut of graded C.I.
- Disc. Shall be stainless steel

4.13 Y-Strainers - The strainers shall either be Y type of fabricated steel body, tested up to pressure applicable for the valves. The strainers shall have a perforated S.S. sheet screen with 3 mm perforation, filtration area of minimum 75%, Y- strainers shall be provided with flange ends. The strainers shall be designed to facilitate easy removal of filter screen for cleaning, without disconnection of pipe line.

4.14 Flow Switches : Sockets or necessary arrangements to be made by HVAC Contractor for bellow type flow switches shall be provided in condensing water outlet and chilled water outlet at the water chilling machines. The flow switches shall prevent the compressor from starting unless the water flow is established in condensing water lines, and chilled water flow is established in chilled water lines.

4.15 Temperature Gauges (Industrial Glass Thermometer type) :-

It Shall be stem type with centigrade & Fahrenheit scales. Temperature gauge shall be of the separate able socket type and shall have extended brass stem, where required, for insulated pipes. Temperature gauge shall be installed at supply and return at chillers & condensers. Range of scales shall be 30-120 .F (0-50 Deg C).

4.16 Pressure Gauges - It shall be brass bourdon tube type, 150 mm Dial, 3/8" BSP bottom connection, 0-7 kg. Per sq.cm (0-100 psi). They Shall be installed on inlet and outlet at chillers, condensers and pumps. They shall be connected to the pipes by welding socket, GI nipple, S.S. Ball valve (Shenco - Make), S.S. U-tube, S.S. Socket & PI.

4.17 Pipe Insulation Procedure: (Outdoor) - Insulation material shall be fire retardant TF quality expanded polystyrene moulded pipe section of density 24 kg/cum and a thickness of 75 mm in pipe section form, $K=0.035$ Kcal / hr.m.Deg.C and (glass wool not accepted).

Application - The surface to be insulated shall be thoroughly cleaned and allowed to dry. CPRX compound of STP confirming to IS 702 shall be uniformly applied @1.5Kg / Sq m on the surface to be insulated. A similar layer shall also be applied on the inside surface of the insulation. Insulation sections shall be stuck to the surface with the joints staggered. The adjoining sections shall be tightly pressed together. All the joints shall be sealed with CPRX. Voids will be sealed with suitably cut pieces. Sections shall be held by PVC packing strip of 1/2" width at gap of 800 mm. Cover the pipe section with 250 micron thick white polythene followed Aluminum cladding of 26G thickness should be done as outer finish.

4.18 Pipe Insulation Procedure (Indoor): Same as above.

4.19 Insulation Procedure for Valves & Flanges : Same as above.

4.20 Painting :

All exposed metal surface of pipes, fittings, pump base frame, RCC foundation and supports must be applied with one coat of Epoxy primer & two coats of epoxy ICI / Nerolac paint of Approved shade. The surface to be painted shall be cleaned thoroughly before painting.

5 Electrical Systems :

5.1 Electrical Power Panel :

The HVAC main electrical power panel for providing power to the water chilling units and pumps shall be provided by the bidder. The panel should be in two parts having different incommers. One part for chillers and other for all pumps and other associated outgoing. The panel should have digital VAF meter with energy parameter (kVAH & kWh both) of conserv make at incomer & all ACB outgoing section along with CT's & PT's as required. The accuracy class of the meter with CT's, PT's shall be 0.5 or better. This panel should following:

Part-1:

Incomer: ACB, 1000A, 3 pole, 415 V Manually operated draw out type - 1 Nos.

Outgoings: ACB, 630A, 3 pole, 415 V, Manually operated draw out type - 2 Nos. for chilling units

Part-2:

Incomer: ACB, 800A, 3 pole, 415 V Manually operated draw out type - 1 Nos.

Outgoings:

1. MCCB, 630A, 3 pole, 35 kA, (AHU/BH-III panel- 1) - 1 No.
2. MCCB, 200 A, 3 pole, 35 kA, - 2 Nos.(in use-1, spare-1)
3. MCB, 63A, 3 pole, 10 kA - 3 Nos. spare
4. MCB, 32A SP, 10 kA - 10 Nos. spare
5. Star-delta starters of required capacity suitable for chilled and condenser water pumps as per required capacity of pumps with MCCB, contactors, timer, O/L relay, single phase preventer, on/off push buttons and indicators, auxiliary contactors for interlock, wiring, CT's, PT's as required, digital VAF meter etc complete as required. -10 Nos.
6. DOL starters of 10 HP- suitable for existing cooling tower fans with MCCB/MCB, contactors, timer, O/L relay, single phase preventor, on/off push buttons and indicators, digital VAF meter etc complete as required. - 4 Nos.

5.2 Automatic Power Factor Correction (APFC) Panel

The APFC panel shall be of capacity 150 kVAR having 5 stages. The 5 stages shall be 50, 40, 25, 25, 10 kVAR It shall be controlled with microprocessor based APFC relay. The panel should have individual MCCB's/MCB's and suitable size capacitor duty contactors and All Polypropylene (APP) type 3 phase, 415 V AC capacitors for each stage. It should have incommer MCCB of 400 Amp, 3 pole, 35 kA with magneto-thermal release. The following should be MCCB /MCB rating of capacitor stages.

50 kVAR - 160 Amp, 25 kA MCCB

40 kVAR - 100 Amp, 25 kA MCCB

25 kVAR – 63Amp, 10 kA, MCB

10 kVAR – 32 Amp, 10 kA, MCB

5.1.1 Panel Construction

Features:-

- Cubicle type switchboard shall be fabricated out of sheet steel not less than 2.5/2.0 mm. thick MS sheet for load bearing and non load bearing members. Wherever necessary, such sheet steel members shall be stiffened by angle iron framework.
- General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. Each

section of the near accessible type board shall have hinged access doors at the rear. Multi tier mounting of feeders is permissible. The general arrangement for multi-tier construction shall be such that the horizontal tiers formed present appealing and aesthetic look. The general arrangement shall be got approved before fabrication.

- The openings between bus chamber and feeder compartments shall be properly covered with bakelite/Hylam sheets of 3mm minimum thickness. The vertical bus bar chamber shall be provided with removable bolted cover in the front and back side. All the inter connection to the feeders shall be shrouded so as to avoid accidental contact by means of bakelite barriers of at least 2 mm thickness.
- Cable entries for various feeders shall be from the top/bottom and shall be accessible from both front and rear through cable alleys located between two circuit sections. Cable alleys shall have hinged doors with rubber gaskets. All cable entries shall be through gland plates. There shall be a separate gland plate for each cable entry so that there will not be dislocation of already wired circuit when new feeders are added. Cable entry plates shall therefore be sectionlised. The construction shall include necessary cable supports for clamping the cable in the cable alley or rear cable chamber.
- Each compartment shall have its own hinged door with concealed hinges. The door shall have square section rubber gaskets fixed on the inner side.

The panels shall be of Simplex type as indicated in the Specific Requirements. The panels shall be sheet steel enclosed, dust and vermin proof with minimum degree of protection not less than IP-54 in accordance with IS:2147. The panels shall be floor mounting free standing type mounted on a supporting structure so as to form a rigid enclosure suitable for the application. The panels shall be fabricated out of CRCA sheet steel of minimum 3 mm thickness for the front and back covers, doors and load bearing members and 2 mm for the rest. All doors and openings shall be provided with neoprene gaskets. Ventilating louvers, if provided shall have screens and filters. The screen shall be made of either Brass or GI wire mesh.

The panel shall be provided with integral base frame. The integral base frame of panels shall be suitable for directly bolting with the help of foundation bolts and shall also be suitable for tack welding to the plant room floor embedded insert plate/ flat/ channel. Amply dimensioned oblong holes shall be provided at the bottom of all panels for bolting on to the embedded insert channel. The height of the panels shall be matched with the other existing panels in the plant room and the bottom of the panels shall have a 100 mm kick plate all around. Cable entry shall be from the top unless specified otherwise. A suitable removable undrilled gland plate shall be provided for cable entry. Suitable compression type cable glands as required for cable termination in the control panel shall be supplied.

The panels shall be matched with other panels in the plant room in respect of dimension, colour, appearance and arrangement of components on the front of the panel wherever specified. Simplex type panels shall be with equipment mounted on the vertical front and access to wiring from rear. Door at the rear shall be provided with handles and lock facility.

5.1.2 Component mounting - All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipment on front of panel shall be flush mounted. No equipment shall be mounted on the doors. Checking and removal of individual components shall be possible without disturbing the adjacent equipment. It should be possible to test all the protective relays 'in-situ'. All components shall be neatly arranged in a matching manner. The internally mounted components, auxiliary equipment such as transducers, interposing CTs etc. shall be mounted in such a way as to be readily accessible without impeding the access to internal wiring and other components. The relay panels shall be supplied complete with channel base grouting bolts, nuts, washers etc.

5.1.3 RATINGS AND REQUIREMENTS: AIR CIRCUIT BREAKERS

Air circuit breakers shall be suitable for 1000/800/630 A continuous current rating, manually operated draw out type with microprocessor release of O/L, S/C, E/F conforming to IS2516. The equipment shall comply to the following minimum specifications:-

- Rated service voltage: 600 VAC
- Rated insulation voltage: 1000 VAC
- Rated impulse withstand voltage: 12 kV
- Continuous rated current: 1000 & 800 A
- Capacity of the neutral pole: 630 A
- Short circuit breaking capacity: 35 kA min
- Short circuit making capacity: 35 kA min
- Operating temperature: [°C] -25...+70
- Frequency: f [Hz] 50 - 60
- Version: manually operated draw out type.
- Protection: O/L, S/C & E/F
- Necessary isolating plugs and sockets.
- Necessary independent manual spring closing mechanism with mechanical ON/OFF indicator as well as electrical ON/OFF indication to be provided at front panel.
- Necessary set of auxiliary switches and indication, metering requirements such as ON/OFF indication, selector switches fuses.

5.1.4 BUS BARS

Bus bars used in the panel shall be of Aluminum E91E grade (IS5052-1981) of adequate section suitable for 3 phase, 4 wire, 415 volt 50HZ AC supply and with short circuit current rating of 50 kA. The bus bar shall have uniform cross section through out the length. The bus bars shall be designed for carrying rated current continuously. The bus bars and links shall be designed for maximum temperature of 75 Deg C. the maximum current density of bus bars shall be 1.28 amps/ sq.mm. suitable de-rating factors shall be applied to arrive at the correct cross section of the bus bars. Bus bars shall be supported on suitable non hygroscopic, non combustible material such as permali or Hylam at sufficiently close intervals to prevent bus bar sag. All bus bar joints shall be provided with high tensile steel bolts (Electro plated with suitable metal such as Nickel/cadmium), spring washers & nuts so as to ensure good contact. Alternatively, electroplated / tinned brass bolts shall be used. The joints shall be formed with fish plates on either side of bus bars to provide adequate contact area. Bus supports shall be provided on either side of joints (max unsupported distance from the joint shall not be more than 300 mm.) power shall be distributed to each circuit in each section by a set of vertical bus bars (phases + neutral). Individual module shall be connected from vertical connections through sleeved connections. Bus bars shall be insulated with heat shrinkable type PVC tapes with color coding (RYB-B). The bus bars and their supports shall be able to withstand thermal and dynamic stresses due to the system short circuits. The supplier shall furnish calculations along with his shop drawing establishing the adequacy of design of both for continuous duty and short circuits rating. Short circuit withstand capacity shall be one second.

5.1.5 Wiring

The wires shall conform to IS: 694. All wiring shall be done with PVC insulated 1100V grade, single core multi-strand (minimum 3 strands) annealed copper conductors. The wires shall be flame proof and vermin proof. The minimum size for different circuits shall not be less than those as specified below:

- 1) Current Transformer Circuit: 1 X 2.5 sq. mm. Copper
- 2) Voltage Transformer Circuit: 1 X 1.5 sq. mm. Copper
- 3) Other Circuit including Control wires: 1 X 1.5 sq. mm. Copper for fuse rating of 10 Amps or less. Each wire shall be identified at both ends with wire numbers by means of PVC ferrules.

Ferruling of wires shall be as per relevant IS. All control wiring shall be enclosed in plastic channels. The terminal blocks shall be located so as to ensure easy access. Split type terminal blocks shall be provided for all CT terminals. The terminal screws shall be of the Washer type and long enough for connecting following type conductor on each side. Each terminal block shall be capable of terminating the following no. of wires:

CT circuits 2 nos 4 mm sq. copper

PT/CVT circuits 2 nos 2.5 mm sq. copper

AC/DC supply circuits 2 nos 2.5 mm sq. copper

All other circuits 2 nos 2.5 mm sq. copper

Each terminal block shall be provided with a wire-marking strip and shall be shrouded by easily removable shrouds moulded of transparent dielectric material.

There shall be a minimum clearance of 250 mm between the front row of terminal block and the associated cable gland plate on panel side wall. The clearance between two rows of terminal block edges shall be a minimum of 150 mm. All inter-panel wiring within each shipping section shall be the vendor's responsibility. Wiring between panels shall be routed through PVC sleeves. For wiring between shipping section, bidder shall provide terminal blocks on adjacent shipping sections and supply suitable jumpers

5.1.6 Earthing

A continuous 50mm X 10mm tinned copper bus shall be provided along the full length of the panels. Suitable arrangement shall be provided at the two ends for connection to the plant grounding system. Each panel and the equipment mounted on each panel shall be securely connected to the grounding bus. For this purpose the ground wire shall be looped from equipment to equipment and both ends of the ground wire shall be connected to the ground bus. All doors and movable parts shall be connected to the ground bus with flexible copper connections.

5.1.7 Illumination & Space heaters

LED lamps working on 240V AC, operated by door switches shall be provided for internal panel illumination in each cable alley. Panel space heaters shall operate on 240 V \pm 10% AC and shall be supplied complete with on-off switch, fuse and thermostat. A common thermostat shall be provided for the entire panel. The thermostat shall maintain the internal temperature above the ambient temperature to prevent moisture condensation. The watt loss per unit surface of the heaters shall be low enough to keep surface temperature well below visible heat.

5.1.8 Switches and fuse

Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of AC supply for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with MCBs. Selection of the main and sub circuit MCB rating shall be such as to ensure selective clearance of sub circuit faults. MCBs shall conform to IS:13947. each MCB shall be provided with one potential free contact and the same shall be wired for annunciation purpose. However VT circuits for relaying shall be protected by MCB's.

5.3 Earthing of Various Equipments

All the equipments of the system shall be earthed at a minimum of two places by using GI earth strips & suitable connecting jumpers as required from the existing earth grid. The main Chilling units shall be earthed by using 50 x 10 mm GI flat at two places drawn from the existing earth grid. The Main electrical panel shall also be connected at two places with the earthing system by using 50 x 10 mm GI earth flats. Pumps should be provided earthing using 25 x 5 mm G.I. strip.

5.4 Power Cable

The XLPE armoured power cable for use on 415 volts system shall be 3 or 3.5 Core with Aluminum / Copper conductors and be of 660/1100 volts grade, as per IS 1554 (Part I) 1964. The cross section of the cable shall be to suit the load and rating of the equipment. The cables shall be of Aluminum conductor, XLPE insulated, strip armoured with overall PVC sheathing.

The cables shall be laid as per IS-1255/1967, Indian standard code of practice.

5.5 Control Cabling/wiring

It Shall be 1.1 kV grade, as per IS 1554, made from copper conductor of suitable cores x 1.5 Sq mm XLPE insulated. strip armoured with an overall PVC sheathing.

5.6 Inspection & Testing :

Pre - despatch Inspection & Testing:

The bidder have to offer pre-despatch test of all electrical items at their works. Enough time gap shall be provided by the bidder between the inspection call & the date of inspection. The bidder have to me all necessary arrangements of tests as may be felt necessary by the IUAC engineers as per standards.

PRE-COMMISSIONING TESTS AND COMMISSIONING:

The panels shall be commissioned only after the successful completion of the following tests. The tests shall be conducted in the presence of IUAC representative/ Engineer.

- All the main & auxiliary bus connections shall be checked and tightened.
- All the wiring terminations & bus bar joints shall be checked and tightened.
- Wiring shall be checked for correctness as per the drawings.
- All wiring shall be tested for insulation resistance by 1000 V megger & panels shall be hi-pot testing at 2.5 kV.
- Phase rotation tests shall be conducted
- Suitable injection tests shall be applied to all the measuring instruments to establish the correctness & accuracy of calibration and working order.

All relays and protective devices shall be tested for correctness of settings & operation by introducing a current generator & an ammeter in the circuit.

Technical Data

TO BE SUBMITTED BY BIDDER WITH TECHNICAL BID

	<u>Item (Bidder's Scope & deemed to include in quoted price)</u>	<u>To be filled by Bidder</u>
1	<u>Water Cooled Screw Type Water Chilling Unit</u>	
1.1	Make	
1.2	Model	
2	<u>Chilled / Condenser Water Pumps</u>	
2.1	Make	
2.2	Model	
3	<u>FRP Induced Draft Cooling Towers</u>	
3.1	Make	
3.2	Model	
4	<u>Manual Geared Trolley</u>	
4.1	Make	
4.2	Model	
5	<u>NRV / Check Valves</u>	
5.1	Make & Model	
5.2	Sizes	
6	<u>Balancing Valve</u>	
6.1	Make & Model	
6.2	Sizes	
7	<u>Y-strainer</u>	
7.1	Make / Model	
7.2	Size	
8	<u>Pressure Gauges</u>	
8.1	<u>Make & Model</u>	
8.2	<u>Sizes</u>	
9	<u>Industrial Glass Thermometer</u>	
9.1	Make	
9.2	Model	
10	<u>Pipe</u>	
10.1	Make	
10.2	Sizes	
11	<u>Flow Switch</u>	
11.1	Make / Model	
11.2	Size	
12	<u>Butterfly Valves</u>	
12.1	Make & Model	

12.2	Sizes	
13	<u>Pressure Relief Valve</u>	
13.1	Make & Model	
13.2	Sizes	
14	<u>Pipe Flanges</u>	
14.1	Make & Model	
14.2	Sizes	
15	<u>Pipe Fittings</u>	
15.1	Make & Model	
15.2	Sizes	
16	<u>Automatic Air Vent</u>	
16.1	Make & Model	
16.2	Sizes	
17	<u>S.S. Braided S.S. Bellow with M.S. Flange</u>	
17.1	Make	
17.2	Model	
18	<u>ACB</u>	
18.1	Make & Model	
18.2	Current Capacity	
19	<u>MCCB</u>	
19.1	Make & Model	
19.2	Current Capacity	
20	<u>Push Button</u>	
20.1	Make	
20.2	Model	
21	<u>LED Indicators</u>	
21.1	Make	
21.2	Model	
22	<u>Electronic Return Air Temperature Sensor</u>	
22.1	Make	
22.2	Model	
23	<u>Digital Temperature Indicating Unit, 1" LED</u>	
23.1	Make	
23.2	Model	
24	<u>Electronic LOW/HIGH Level Sensor</u>	
24.1	Make	
24.2	Model	
25	<u>Digital Level LOW/HIGH Indicating Unit, 1" LED</u>	

25.1	Make	
25.2	Model	
26	<u>Power Cable</u>	
26.1	Make	
26.2	Model	
27	<u>Control Cable</u>	
27.1	Make	
27.2	Model	
	BIDDER to confirm that materials, accessories and design pressures shall be as specified in Data Sheet & Technical Specifications. Deviation if any should be clearly stated.	
	Performance curve/rating charts with operating points marked.	

List Of Approved Makes		
S.N	Equipment/Material	Approved Manufacturer
1.	Chilling Unit	Trane / Carrier / York/Daikin
2	Cooling Towers	Mihir / Paharpur / Advance
3	Pumps	Grundfoss / Armstrong/Beacon /Kirloskar/KSB/CG
<u>Piping (Chilled/Condenser/Drain Water)</u>		
1	Y-Strainers	Emerald/ Rapid Cool/ Flowell/Bhatia Engineering
2	Pipes (upto 200mm)	Jindal-Hissar/ Jindal-Star/Tata/Sail
3	Pipes (Beyond 200mm)	Jindal-Hissar/ Jindal-Star/Sail
4	Butterfly Valves (Water Duty)	Audco/ Advance
5	Check Valves (Water Duty)	Audco/ Advance
6	Ball Valves (Water Duty)	Cimm/ RB/ Arco/ KSB/ CG/Shenco
7	Balancing Valves (Water Duty)	Audco /ADVANCE
8	Two / Three Way Motorized Modulating Valves For AHU's	Danfoss / JOHNSON Control/ Honeywell / Siemens / Belimo
9	Pressure Gauges	Feibig/ Guru/ Honeybell/ Emerald
10	Industrial Glass Thermometers	Emerald/ Guru/ Honeybell
11	Water Flow Switch	Danfoss/ Rapid Control/Anergy/ Emerald/ Johnsons Control
12	Pipes Bellow	Resistoflex/ Easyflex/ Vallabh / SBM / Equiv.
13	Auto Air Vent	Rapid Control/ Hawa/ Leader
14	Micro Processor Based Controllers	Honeywell/Johnson/Hawa/Siemens/Belimo/Danfoss
15	Digital Sensors /Controller / Display (Pressure/Temperature)	Johnson Control/Anergy/ Honeywell/Siemens
16	Control Valves	Avcon / Toshniwal/KSB/IT
17	Instruments	IT / Taylor / Bells / Honeywell
18	Vibration Pads	Resistoflex/ Dunlop/ Kanwal
19	Aluminium Tape	Johnson/Birla 3m/Garware
20	Enamel Paint	ICI/ Asian/ Nerolac/Berger
21	Bituminus	Shalimar
22	Anchor Fasteners	Cannon/ Hilti/Fisher
Thermal Insulation		
S.N	Equipment/Material	Approved Manufacturer

1	Expanded Polystyrene(Tf Quality)	Beardsell/Lloyd/Thermobreak/ Armaflex
2	Pre Laminated/Plain Fibre Glass Rigid Boards	Uptwiga/Owens/Corning/ Thermobreak/ Armaflex
3	Pre-laminated Glass Wool Blankets	Uptwiga/Owens/Corning/Thermobreak/ Armaflex
4	Glass Wool Blankets	Uptwiga/Armaflex
5	Extruded Polysterene	Supreme/ Armaflex
6	Elastomeric/Cross Linked Polyethylene Foam	Trocellene/Thermoflex/Armaflex
7	Pre-moulded Puf Section For Pipe Supports	Malanpur /LLOYD
8	<u>Fire Sealant</u>	Hilti / Birla 3 M
Electrical Items		
S.N	Equipment/Material	Approved Manufacturer
1	LT Panel and Sub Panel's	Precision System Control/ SPC Electrotech/ Nitya Electrocontrol Pvt Ltd./Risha Control/equiv.
2	Battery Charger	Ambit/Crompton Greaves/Mahamaya
3	ACB's	Schneider / Siemens /ABB/ L&T
4	MCCB's	Schneider / Legrand /Siemens
5	MCB's & DB's	Legrand/Schneider/Indo -Asian/Siemens
6	ELCB's, RCBO's & RCCB's	Legrand/Schneider /L&T/ Siemens
7	MPCB's :	Legrand/Schneider/Eaton /Siemens
8	HRC Fuses & Fues Switch Units	L & T/Siemens/ GEC Alsthom/ Siemens
9	Contactors & O/L relays with in built SPP	Telemecanique/Siemens/L & T
10	SPP	Minilec
11	Indication Lamps	Schneider/ESSBEE-L&T/Siemens/Cutler Hammer
12	Push Buttons	Schneider/ESSBEE-L&T/Siemens/cutler Hammer
13	Selector Switches	Kaycee/Siemens/GE
14	Electrical Terminals	Elmax/Connectwell
15	Multifuction Meter – Digital / Multifunction / VAF	Conzerv/Secure
16	(BMS / Non BMS compatible)	AMTL/Secure
17	Meters-Analogue	Rishab-L&T/AE/Conzerv/Siemens/KAPPA
18	Timers	Alsthom
19	Relays (Numeric Type)	Schneider / L&T/ Areva
20	Relays (Electromagnetic Type)	Areva/ Easun Reyrolle
21	Capacitors	Ducati/Neptune/Siemens/Epcos
22	Cast Resin Current Transformers	Kappa/Precise/Gilbert Maxwell/Pragati

23	Potential Transformers	Maxwell/Pragati
24	Automatic power factor correction relay	EPCOS/Areva/Ducati/Siemens/L&T
25	Annunciator	Alain /Minilec
26	Power Cable	Finolex//Havells/Gloster/Finolex / Rallison
27	Fire Survival armoured cable of 600/1000V	Tyco/Polycab/Bonton/Fusion
28	Cable lugs & thimbles	Dowells/Comet
29	Cable glands	Comet/Lotus
30	GI Cable trays & GI Raceways	Slottco/Skabar/MAA Industries/equiv.
31	Rising Main / Bus duct	GE/Schneider Electric /C&S/Legrand
32	Maintenance Free Chemical Earthing	LPI/ Ashlok/Foruntec
33	Electronic Digital Meters	Conzerv/Secure
34	PVC insulated copper conductor stranded flexible wires (FRLS)	Polycab/Finolex/Lappe Cable/Havells/RR Kabel
35	Conduits (MS and PVC)	BEC /AKG/RMCON/ JPC/Avonplast
36	Electric motors	Siemens / crompton / NGEF / kirloskar / Bharat Bijlee

NOTE:

- a) Above makers of materials are approved subject to their meeting the bid specification & site requirements.
- b) The contractor shall supply ISI marked material as per of the makes/brands indicated above. In case, the firm is not manufacturing ISI marked material for any of the brands, first quality material shall be accepted.
- c) The samples of the material shall in either case have to be got approved from the Engineer-in-charge.
- d) Material where no make/brand has been mentioned, in this case ISI marked samples shall be submitted by the contractor for approval of Engineer.
- e) Contractor will be responsible to ensure the quality of products listed in approved list of makes. Contractor will have to replace the defective and sub-standard materials at his own cost.

PART “B”: SCHEDULE OF QUANTITIES (Price Bid)**Annexure-III****(Prices should be quoted only in .XLS BOQ Format attached)**

S. No.	Description of the Item (Item Rates quoted below should be on Supply, Installation, Testing and Commissioning Basis as per Scope of Work, Technical Specifications, data sheet & special conditions mentioned in the bid etc.)	Units	Estim ated Qty.	Rate (Exclud ing GST)	
1	Supply cost of Microprocessor controlled SITC of Water cooled Screw type Chilling Unit, twin rotor screw compressor, single compressor, single stage, direct driven, semi-hermetic sealed, Cooling Capacity 756000 K.Cal/hour (250TR) minimum, at Chilled water inlet / outlet temperature - 12.2/6.67 °C, chilled water Flow rate of 2270 LPM / as required, Condenser Water Inlet / outlet Temp. 32.2 °C / 36.4 °C, Condenser Cooling water Flow rate of 3634 LPM / as required, operating on 134a refrigerant, Fouling Factor for chiller-0.0005 (FPS), Fouling Factor for condenser- 0.001 (FPS), less than 0.67 IKw/Ton, complete working unit as per specifications and as required including : a) Compressor with automatic capacity control b) Electric Motor, suitable capacity, induction type, 415V+-10%, 3Ph, 50Hz, 2900 RPM c) Necessary drive arrangement d) Condenser as required e) Chiller as required f) Support frame work for mounting of above compressor, motor, condenser, chiller with base plate and anti vibration pads / springs as required g) Internal refrigerant piping, valves, expansion device, h) Oil feed system, oil recovery, oil heater, oil circulation system as required i) Factory insulated all cold parts with 25 mm thick nitrile rubber with cover of 3 mm thick PVC sheet for vapour barrier as required. j) Factory charged refrigerant and oil as required k) Factory fitted unit mounted VFD starter with MCCB l) Digital display with microprocessor control, latest working / safety features, touch control, BMS compatible control panel as required m) RCC foundation - R.C.C. foundation of two slabs one for each foot shall be of size (LxWxH) mm 1600 x 900 x 250 or as per manufacturer's drawing, for each chilling unit. It should be made of all around frame of M.S. equal angle 50 x 50 x 6 mm, steel reinforcement grid of 100 mm max., made of steel bar-8 mm, cement: sand : concrete moisture of 1:1.5:3 to be made on existing floor after chipping, exposing & welding with the old reinforcement, M.S. Plate of 12 mm thickness, dimension as per the foot prints of chiller legs shall be grouted and leveled.	Sets	2		
1.01	Placement, installation, testing, commissioning of item no. 1	Sets	2		
1.02	Flow switch, Size – 1" BSPTM, S.S. leafs including welding of M.S. Heavy & long threaded socket on pipe, wire etc.	Sets	4		

1.03	Pressure relief valve, Size – 1”, NB150 lbs, Brass / Bronze body with M.S. Heavy & long threaded Socket welded on pipe, M.S. heavy Threaded nipple, S.S. Ball Valve (Shenco) for Chiller Unit condenser / evaporator return lines.	Sets	8		
1.04	Providing nozzles, Size-1” NB, for drain, chemical circulation, inlet / outlet of Chiller including welding of M.S. Heavy long threaded Sockets, S.S. heavy threaded nipple and S.S. Ball valve screwed ends (Shenco-make).	Sets	12		
1.05	Charges towards Spares Parts suitable for Item no-1 as below: i. Touch type Controller / Display unit with screen	no.	1		
1.06	Electronic Refrigerant Expansion valve	no	2		
1.07	Temperature transducer for condenser / evaporator water and refrigerant.	no.	6		
1.08	Pressure transducer for evaporator / condenser water and refrigerant	no.	4		
1.09	Solenoid valve for oil return line	Set	2		
1.10'	Solenoid valve for master oil line	Set	2		
1.11	Solenoid valve for load, unload control	Set	2		
1.12	Oil loss level switch	Set	1		
1.13	Oil Heater	Set	2		
1.14	Refrigerant Liquid Level Sensor	Set	2		
1.15	Oil / Refrigerant Filter Element	Set	2		
1.16	Annual maintenance Contract charges for next five years after warranty period, including quarterly preventive maintenance visit, to attend all break down visits, oil testing once a year, descaling of condenser once a year etc. (AMC shall be carried out by the OEM/OES. Bidder shall facilitate the same to place the AMC directly on OEM / OES of Chiller) 1 st Year	no.	1		
1.17	2 nd Year	No	1		
1.18	3 rd Year	No	1		
1.19	4 th Year	No	1		
1.20	5 th Year	No	1		
2	Chilled Water Horizontal centrifugal pump, back pull out type, flow rate - 150 CMH or suitable for quoted chiller unit against working Head - 45 m approx or as required, complete working unit as per specifications and as required including: a) Water pump as required b) Electric Motor, SPDP squirrel cage induction Class-B motor, Insulation Class-F', 415V+-10% volts, 3 Phase, 50Hz, 1450 RPM as required c) Mechanical seal as required d) Flexible spacer coupling set as required e) 32 mm thick nitrile rubber foam insulation on pump casing f) Mounting Common frame for pump and motor : The pump and motor shall be mounted on a common frame, fabricated	Sets	2		

	<p>from MS C-channel of 125 mm x 6 mm thick minimum fabricated steel, painted with one coat of epoxy primer and two coats of epoxy paint. The single base plate (grinding finish), 12 mm thick, shall have rigid, flat & true surfaces, each for the pump and motor mounting feet. It shall have necessary holes for grouting to the foundation, mounting fasteners for pump and motor, T/L grouting bolts as required.</p> <p>g) Foundation / inertia block : Only one Pump and motor assembly to be installed on each inertia block. The total weights of pump and inertia block shall be twice to thrice the weights of the pump/motor/base plate. The inertia solid block of minimum Size of extending 150 mm all around the base frame, suitable height (not less than 250 mm) with all around frame of M.S. equal angle 50 x 50 x 6 mm, steel reinforcement grid of 100 mm max. made of steel bar 8 mm dia, cement : sand : concrete mixture of 1:1.5:3 to be made, properly leveled and 12.5 mm thick plastered with water proofing cement, duly painted with water proofing paint. The inertia block shall be floating on vibration pads of 150 x 150 x 12 mm - 4 nos each placed at total 12 places as required.</p> <p>h) Axial and radial alignment between motor and pump shaft <0.05 mm.</p>				
3	<p>Condenser Water Horizontal centrifugal pumps, back pull type, each of the flow rate mentioned below, against working Head- 25 m approx. or as required, complete working unit as per specifications and as required including:</p> <p>a) Water pump as required</p> <p>b) Electric Motor, SPDP squirrel cage induction Class-B motor, Insulation with class- F, 415V+-10% volts, 3 Phase, 50Hz, 1450 RPM as required</p> <p>c) Mechanical seal as required</p> <p>d) Flexible spacer coupling set as required</p> <p>e) Mounting Common frame for pump and motor : The pump and motor shall be mounted on a common frame, fabricated from MS C-channel of 125 mm x 6 mm thick minimum fabricated steel, painted with one coat of epoxy primer and two coats of epoxy paint. The single base plate (grinding finish), 12 mm thick, shall have rigid, flat & true surfaces, each for the pump and motor mounting feet. It shall have necessary holes for grouting to the foundation, mounting fasteners for pump and motor, T/L grouting bolts as required.</p> <p>f) Foundation / inertia block : Only one Pump and motor assembly to be installed on each inertia block. The total weights of pump and inertia block shall be twice to thrice the weights of the pump/motor/base plate. The inertia solid block of size extending not less than 150 mm all around the base frame, suitable height (not less than 250 mm) with all around frame of M.S. equal angle 50 x 50 x 6 mm, steel reinforcement grid of 100 mm max. made of steel bar 8 mm dia, cement : sand : concrete mixture of 1:1.5:3 to be made. properly leveled and 12.5 mm thick plastered with water proofing cement, duly painted with water proofing paint. The inertia block shall be floating on vibration pads of 150 x 150 x</p>	Sets	3		

	12 mm - 4 nos each placed at total 12 places as required g) Axial and radial alignment between motor and pump shaft <0.05 mm. i. Flow capacity – 240 CMH or as required				
3.1	Flow capacity – 190 CMH or as required (Specifications same as item #3)	sets	2		
3.2	Providing nozzles, Size - 1/2” NB, for inlet / outlet of pumps including welding of M.S. Heavy threaded Sockets and S.S. Plug.	sets	5		
4	FRP Cooling towers of 825000 kcal/hour (275 TR) heat rejection capacity, flow capacity of 275 m ³ /h, condenser Water Inlet/Outlet Temp. 36.4 /32.2 °C, Design ambient WBT- 28.2 °C, Design Approach- 3.9 °C with assembly with FRP water basin of not less than 300 mm height, PVC fillings with integral louvers and drift eliminators complete with hot water basin / PVC pipe header fitted with spray nozzles, statically and dynamically balanced axial flow type direct driven or driven through reduction gear box fan- with TEFC induction motor, suction screen, drain connections with valve, suitable inspection ladder, access arrangement for cooling tower interior, fan blades & hub assemblies, fan casing, water distribution system, water outlet S.S screen, side panels, fan guard, internal support, inlet & outlet flanges etc. complete as per specification and technical data sheet.	Sets	2		
4.01	Digging in hard soil / Stone area up to depth of 500 mm and shifting of malba at suitable place at distance of 800 mm in to site.	Cum	20		
4.02	Foundation made of RCC pillars / beams of suitable size and number (Cooling tower will be installed at 6 ft high from floor level) suitable for Cooling Tower as per Manufacturer's design including digging 3ft x 3 ft x 3ft in Stone area etc. M.S. Tor Bar Jaal, 150 mm grid made of 8 mm minimum dia M.S. tor bars, made with water proof cement: sand: concrete mixture 1:1.5:3, properly leveled and 12.5 mm thick plastered with water proofing cement. Duly painted with water proofing paint.	Cum	40		
4.03	Water proofing painting with one coat of suitable primer and two coats of paint for item #4.2, 2 (g), 3 (f) & 4.	Sqm	165		
4.04	Steel C- Channel base, Hot Deep Galvanised Steel, Size-150x75x6.5, bottom flange shall be grouted on RCC beams with 5/8” Dia bolts, Top flange shall be bolted to Cooling tower bottom ends. Intermittent support grid of 750 mm of L-Section-50x50x6 mm shall be provided including one coat of epoxy primer and two coats of Grey Shade epoxy paint. Suitable for item no. 4.1	kgs	1200		
4.05	Steel Structure made of Hot Deep Galvanised Steel I-Beam, plate, sections of suitable size and design approved by IUAC engineer, for Overhead operation for removal / re-fixing of cooling tower fan motor over 4 no.- cooling towers including one coat of epoxy primer and two coats of Grey Shade epoxy paint, fasteners, plates, scaffolding etc.	kg	2500		
4.06	Manual Geared Trolley suitable for 1 Ton Capacity Manual Chain	no	2		

	Pulley Block.				
4.07	Isolator on / off switch of 32 Amp, for cooling tower fan with weather proof FRP / plastic box of suitable size with door with wing nut.	no	4		
4.08	Local on / off control of cooling tower fan motor on cooling tower for each tower including weather proof FRP / PVC box and controls . Cable as per item rate -21.	Nos	4		
4.09	Automatic on / off control of cooling tower fan motor complete including water temperature sensor, temperature controller, addition / modification in electric fan motor starter panel, supply and welding of M.S. Socket in return header etc. (cable as per BOQ Item rate – 21).	nos	4		
4.10	Digital Water Low / High Level Sensor (Stainless Steel) with Low / High level signal for Expansion Tank (height of 1200 mm) & Cooling tower under ground Tank (height of 2000 mm) for Indicating unit at a distance of upto 100 meters.	sets	4		
4.11	Digital water level LOW / HIGH, 1” LED Indicating unit suitable for above unit including one no. of alarm and blinking light signal.	sets	4		
5	M.S Black Pipe, ERW (including fittings like tee, bends, reducers, supports, necessary clamps, vibration isolators but excluding valves, strainers, gauges, flanges) as per specifications and as required of following sizes: Size - 12" NB, 6 mm thick, as per IS – 3589 including 3 mm thick corrosion protection painting / coating.	RM	30		
5.1	Size - 8" NB, 6 mm thick, IS – 3589 (Specifications same as item #5)	RM	140		
5.2	Size – 6" NB, Heavy Class, IS-1239 (Specifications same as item #5)	RM	60		
5.3	Size - 4" NB, Heavy Class, IS-1239 (Specifications same as item #5)	RM	24		
6	M.S. Flanges, rating – 150 lbs, ANSI B16.5, RF-serrated type including gaskets, bolts, nuts & washers etc. as required as following: Size - 12"NB	Nos.	6		
6.1	Size - 8" NB (Specifications same as item #6)	Nos.	108		
6.2	Size - 6" NB (Specifications same as item #6)	Nos.	8		
6.3	Size - 5" NB (Specifications same as item #6)	Nos.	7		
6.4	Size - 4" NB (Specifications same as item #6)	Nos.	18		
6.5	Size – 2" NB (Specifications same as item #6)	Nos.	9		
7	Blind Flange, rating 150 lbs, RF-serrated type including gaskets, bolts, nuts & washers etc. as required as following: ISize - 12"NB	Nos.	2		
7.1	Size – 8"NB (Specifications same as item #7)	Nos.	4		
7.2	Size – 6"NB (Specifications same as item #7)	Nos.	4		
7.3	Size – 4"NB (Specifications same as item #7)	Nos.	1		

7.4	Size – ½"NB (Specifications same as item #7)	Nos.	2		
8	Butterfly Valves, PN16 rating I. Size - 8" NB	Nos.	26		
8.1	Size - 6" NB (Specifications same as item #8)	Nos	8		
8.2	Size - 4" NB (Specifications same as item #8)	Nos	4		
8.3	Fixing (only) of 4"NB after descaling	Nos.	2		
8.4	Size – 2" NB (Specifications same as item #8)	Nos.	2		
9	8" NB, NRV, Dual S.S.Plate Center Hinged type, Spring loaded, C.I. Single piece cylindrical Body, Pressure ratings PN10 :	Nos.	15		
10	Balancing Valve, C.I. Body, Flange ends, PN 10, S.S. Disc & stem, with micro meter scale, pressure test brass cocks : Size-8" NB	Nos.	8		
10.1	Size-4" NB (Specifications same as item #10)	Nos	1		
11	8" NB, Y-strainer, M.S. Fabricated body, 3 mm S.S. mesh, Flange ends, PN10	Nos.	7		
12	Pressure Gauge 6" Dial, Range 0-10 kg/sqcm, bottom connection 3/8" BSPT, brass bourdon tube with Extra Long M.S. Threaded Heavy duty Socket welded on pipe, S.S. Nipple Sch 40, S.S. Ball Valve (Shenco - make), S.S. U-tube (Sch 40), S.S. Bar socket etc.	Sets	31		
13	Industrial Glass Thermometer, Range 0-50 Deg C, Size-3/4"BSPT, M.S. Long Threaded Heavy duty Socket welded on pipe, long heavy duty bellow made from brass bar.	Sets	12		
14	Thermal Insulation of with 75 mm thick TF quality expanded polystyrene pipe section of density 24 kg/cum, applying of CPRX by brosh on both surfaces of pipe and TF section, hold together by the PVC strip of ½ " width at 600 mm gap, wrapping of polythene sheet of 250 micron thickness as vapour barrier, joint sealed with 4" wide PVC tape & covered by 26 G Al. sheet cladding etc. as per specifications of the following sizes: Size - 8" NB Pipe	Rm	30		
14.1	Size - 6" NB Pipe (Specifications same as item #14)	Rm	60		
14.2	Size - 4" NB Pipe (Specifications same as item #14)	Rm	24		
14.3	Butterfly / check valves 8" NB size (Specifications same as item #14)	Nos.	12		
14.4	Balancing Valves / Y-Strainer, 8" NB size (Specifications same as item #14)	Nos.	5		
15	S.S. Bellow, PN 10, M.S. End flange (drilling as par ANSI B16.5), S.S. Braid with alignment studs as below: Size : 8" NB x 150 mm long	Nos	22		
15.1	Size : 8" NB x 150 mm long (fixing in old pipe line after cutting and re - welding of the same. (Specification same as item #15)	Nos	14		
15.2	Size : 4" NB x 150 mm long (in old pipe line after cutting and re - welding of the same. (Specification same as item #15)	Nos	4		
16	The electrical power LV panel board of cubical type, compartmentalised design made of 2.5 mm and 2 mm thick CRCA powder coated sheet having necessary cable alleys,	Lot	1		

	<p>connections and inter-connections suitable for 415V/3Ph/50Hz/35MVA rupturing capacity providing power to the water chilling units, pumps, cooling Towers, AHU's etc. The panel should have digital VAF meter with energy parameter (kVAH & kWH both) of konzerv make at incomer & ACB outgoing section along with CT's & PT's as required. The accuracy class of the meter with CT's, PT's shall be 0.5 or better. This panel should also have following incoming / outgoing.</p> <p>a) Manually operated draw out type incomer ACB of 1000 Amps & 800 Amps, 3 pole, 415 V, 35kA breaking capacity- 1 nos each</p> <p>b) Manually operated draw out type 630A, 3 pole, 415 V, ACB outgoing for chilling units - 2 nos</p> <p>c) Star-delta starters of required capacity (40 HP approx.) suitable for chilled/condenser water pumps as per required capacity of pumps with MCCB, contactors, timer, O/L relay, single phase preventor, On-Off indications, push buttons, VAF Meters etc complete as required. - 10 nos</p> <p>d) DOL starters of 10 HP- suitable for existing cooling tower fans with MCCB, contactors, timer, O/L relay, single phase preventor, On-Off indications, push buttons, VAF Meters etc complete as required – 2 nos</p> <p>e) DOL starters of suitable capacity and number suitable for the quoted cooling towers fans (2 no. of 5HP each or 1 no. of 10 HP each) with MCCB, contactors, timer, O/L relay, single phase preventor, On-Off indications, push buttons, VAF Meters etc complete as required – 2 nos</p> <p>f) 630A, 3 pole, 35 kA, MCCB with VAF meter (AHU/BH-III panel- 1) – 1 nos</p> <p>g) 200 A, 3 pole, 35 kA MCCB, with VAF meter (in use-1, spare-1) – 2 nos</p> <p>h) 63A, 3 pole, 10 kA MCB, spare – 3 nos</p> <p>i) 32A SP MCB, 10 kA , spare – 10 nos</p>				
17	<p>SITC of 150 kVAR Automatic Power Factor Correction Panel of 5 stages Microprocessor Controlled APFC relay having 400A MCCB, 35 kA as incomer and 50, 40, 25, 25, 10 kVAR APP type 3 phase power capacitors controlled with 160A, 100A, MCCB and 63A, 32A MCB with suitable size Capacitor Duty Contactors, timers, push buttons, ON/OFF indications, Auto/Manual control etc complete as required.</p>	Set	1		
18	<p>Replacement of Existing control desk including dismantle / disconnection of 2nos of old panels and SITC of new floor mounted desk type control console cum indicating panel complete working unit containing various on/off LED indications and Push button on/off controls. It shall be complete, shall be fabricated from 2.5/2 mm M. S. Powder coated sheet of approved design, contactors, internal wiring, base C-channel, PCC foundation etc. with following indicative accessories:</p> <p>a) Push buttons and LED indicators for remote start & stop and status (On, Off) indication for each condenser / chilled / booster water pumps. - 12 nos</p> <p>b) Push buttons and LED indicators for remote start & stop and status indication for AHU – 12 nos</p>	Set	1		

	<p>c) Push buttons and LED indicators for remote start & stop and status indication (On, Off) for each cooling towers motors – 4 nos</p> <p>d) Low / High water level indication for each cooling tower with the alarm and blinking light signal – 2 nos (as per BOQ Item - 23)</p> <p>e) Low / High water level indicating Unit for each Expansion tank with the alarm and blinking light signal – 2 nos (as per BOQ Item rate- 24)</p> <p>f) The existing cable shall be disconnected from the old panel and the same shall be connected to the new console panel. Any new cable if required shall be supplied and fixed (as per Item rate in S.N. - 21) including terminal block, termination, lugs etc.</p> <p>g) Fixing of digital temperature Indicating Unit and 12 position selector switch for return air temperature from AHU rooms (as per BOQ Item rate- 23) and cable. (cable as per BOQ item rate -21)</p>				
19	Power Cable XLPE insulated PVC sheathed, steel / wire armoured, aluminium conductor cables of following sizes for electric from supply main panel to various loads including interconnections from starters to motors on suitable cable trays / supports, including suitable double compression glands, Terminal lugs, connections etc. as per specifications as required : 1 core x 70 sq mm or as required, copper conductor, 1.1 kV rating, unarmoured for Water chilling Units	Rm	240		
19.1	3 core x 35 sq mm, 1.1 kV rating for chilled /condenser water pumps in existing cable tray	RM	500		
19.2	3 core x 16 sq mm 1.1 kV rating for cooling towers (specifications as above) in existing cable tray	RM	200		
19.3	3.5C x 240 sq mm in existing cable tray / cable trench	RM	200		
19.4	Supply and making cable end termination for 3.5Cx240 sqmm aluminium armoured LT cable by using suitable thimbles, double compression brass cable glands etc as required.	Nos.	4		
20	Installation of 150 mm to 450 mm wide overhead GI ladder type cable tray by providing suitable anchor bolts in ceiling, hanging ronds, angle iron supports etc as required. (Old cable tray shall be used)	RM	50		
20.1	Excavation of 300 mm x450 mm cable trench in ground for laying cables including back filling of same by using suitable quantity sand, bricks etc as required.	RM	15		
21	Control Cable XLPE insulated PVC sheathed, steel / wire armoured, underground copper conductor cables including interconnections between starters, instruments,equipments, control console on suitable cable trays, supports, saddle, clamps, screws, double compression glands, Terminal lugs, termination etc. as per specifications as required :	RM	1000		

	2C x 1.5 sq mm 1.1 kV rating cable				
21.1	3C x 1.5 sq mm 1.1 kV rating cable (specifications same as item #21)	RM	1000		
21.2	6C x 1.5 sq mm 1.1 kV rating cable (specifications same as item #21)	RM	500		
21.3	8C x 1.5 sq mm 1.1 kV rating cable (specifications same as item #21)	RM	1000		
22	Digital temperature sensor PT100 for return air for mounting in AHU rooms and chamber for indicating unit at a distance of upto 100 meters.	Nos	12		
22.1	Digital Temperature Indicating Unit 1" LED suitable for above unit.	Nos	1		
22.2	Rotary Selector Switch with 12 position	Nos	1		
23	Supply & fixing 25 x 6 mm GI strip on surface or recess for earth connection, jointing with the existing strips, complete as required.	RM	20		
24	Supply & fixing 6 SWG dia GI wire on surface or recess for loop earth connection complete as required.	RM	200		
25	Dismantling of Existing Softener Plant including removal of resin tank, sintex water tank, piping, valves, resin, bed material. Lifting , shifting and Re-installation of the same to nearby place including re-assembly of old pipes, new civil foundation, descaling of all valves etc complete as required. (It may or not be executed depending on site condition.)	lot	1		
26	Dismantle of old HVAC main electrical panel including disconnection of all cables and trays, removing from the place, loading, shifting and un loading of the same at a distance of 800 m within IUAC.	Set	1		
27	Dismantling of existing Reciprocating water chiller 100 TR including piping upto header, electricals upto panel, foundation, loading / unloading and shifting of same at a distance of 800 m within IUAC. Valve / balancing valve shall be unbolted from piping without damage and handed over to IUAC. (Please note that the unit shall be shifted in assembled condition with compressor, motor, chiller, condenser, piping)	lot	4		
28	Dismantling of existing chilled / condenser water pumps including piping upto header, electricals upto electric panel, foundation block etc. loading, unloading, shifting of same at a distance of 800 m within IUAC. Valves, Y-strainer, check valve, etc shall be unbolted from pipe without damage and handed over to IUAC. (Please note that the unit shall be shifted in assembled condition with pump, motor, base frame.)	lot	7		

Note :

- It is entirely contractor's responsibility to take dimensions, sizes, quantity from site, design the system, and take IUAC's engineer's approval before actually bringing the material to site.
- Bidder who quote for chilling units of higher than required capacity, will not be given any advantage in price comparison.
- In case of ambiguity in specifications mentioned in BOQ/Data Sheet/ Scope of

work/Technical specification, the superior of all will be applicable. IUAC Engineer-In-Charge decision will be final

- Kindly note that final payment shall be made as per the actual quantities installed. For this a joint measurement of the IUAC and the contractor will have to be taken. The responsibility and the facilitation for taking the measurements will rest with the contractor.

Place:

Date:

Contractor's Signature

Name :

Seal :

TENDER ACCEPTANCE LETTER **(ANNEXURE - IV)**
(To be given on Company Letter Head)

Date: _____

To

The Administrative Officer (S&P)
Inter-University Accelerator Centre
Aruna Asaf Ali Marg
New Delhi-110 067

Sub: Acceptance of Terms & Conditions of Tender

Tender Reference No: _____

Name of Tender / Work: _____

Dear Sir,

1. We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely: as per your advertisement, given in the above mentioned website(s).
2. We hereby certify that we have read the entire terms and conditions of the tender documents from Page No. _____ to _____ (including all documents like Annexure (s), schedule(s), etc .), which form part of the contract agreement and we shall abide hereby by the terms / conditions / clauses contained therein.
3. The corrigendum (s) issued from time to time by your department/ organizations too have also been taken into consideration, while submitting this acceptance letter.
4. We hereby unconditionally accept the tender conditions of above mentioned tender document(s) / corrigendum(s) in its totality / entirety.
5. We do hereby declare that our Firm has not been blacklisted/ debarred by any Govt. Department/ Public sector undertaking.
6. We certify that all information furnished by the our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then your department/ organization shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,

(Signature of the Bidder, with
Official Seal