

**TENDER NO: 12/2023 Dated 03.07.2023**

**INVITATION OF TENDERS FOR SUPPLY, INSTALLATION, TESTING &  
COMMISSIONING OF 1 x 240 TR & 1 X 165 TR  
WATER COOLED SCREW CHILLERS AND ALLIED WORKS  
AT INDRAPRASTHA INSTITUTE OF INFORMATION TECHNOLOGY DELHI  
AT OKHLA-III, DELHI**



**INDRAPRASTHA INSTITUTE of  
INFORMATION TECHNOLOGY DELHI**



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**Indraprastha Institute of Information Technology, New Delhi (IIIT-Delhi)**

DATED: 03.07.20223

**TENDER NOTICE**

1. Last Date & Time of issue of tender documents from 03.07.2023
2. Last Date & Time of receipt of tender 24.07.2023 upto 3.00 p.m.

CE, IIIT-Delhi, Okhla, New Delhi-110020 on behalf of Registrar, IIIT-Delhi invites sealed item rate tenders from eligible contractors for similar works.

Name of work: **SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 1 x 240 TR & 1 X 165 TR WATER COOLED SCREW CHILLERS AND ALLIED WORKS AT IIITD CAMPUS OKHLA PHASE-III, NEW DELHI-110020.**

Location: Ground floor of Lecture Hall Complex (240 TR) &  
1<sup>st</sup> Floor of Service Block (165 TR)

Estimated cost of work put to tender : Rs. 180 Lacs

Time of completion : 6 Months

Earnest Money Deposit: **Rs. 3,60,000/- (Rupees Three Lac Sixty only)** is to be submitted with tender document as earnest money. The above payment shall be made in the shape of deposit at pay order/demand draft of a scheduled bank issued in favour of **IIIT Delhi Collection payable** at New Delhi.

Works to be completed in coordination with the main Civil & MEP Interior works contractor. No extra for non-availability of fronts or coordination with main agency shall be payable on account of the same.

Tender documents can be downloaded from IIITD website ([www.iiitd.ac.in](http://www.iiitd.ac.in)) and submitted with non-refundable DD of **Rs. 1180/-** in favour of **IIIT Delhi Collection** as cost of tender.

- 1) The tenders shall be placed in sealed envelopes with a name of work and due date written on the envelope and addressed to the CE, IIITD. Complete tender documents shall be submitted by the approved contractors in **two envelopes**. **1<sup>st</sup> envelope** shall contain the earnest money in the shape of Demand Draft / Pay Order of a scheduled Bank requisite shape as per condition & eligibility criteria and cost of tender as stated above in case of the downloaded version.
- 2) The eligible contractors who have carried out similar works in IIIT-D/Govt Deptts/PSU/Reputed Pvt sector /MNCs are to submit the experience certificates for the works and registration certificates with Govt. Depts. if any. The said certificates along with the EMD be enclosed in Envelope-1.

- 3) Experience of having successfully completed similar works during last seven years ending on the 30th June 2023. **The Similar works shall mean works of SITC of Minimum 165 TR capacity Water/Air cooled screw chiller.** The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum calculated from date of completion to last date of receipt of tenders.

Three similar works not less than 40% of est.cost	Rs 72 lacs each Or
Two similar works not less than 60% of est cost	Rs 108 lacs each Or
One similar work not less than 80% of est cost	Rs 144 lacs each

- 4) One completed works of any nature either part of 3) or separate one costing not less than 40% of estimated cost ie Rs 72 lacs with some Central/State/Autonomous/Central PSU/State PSU/local authority formed under any Act published in Central/State Gazette.
- 5) **The bidder should be Original Equipment Manufacturer or authorized dealers of OEM and certificate/corroborative documentary evidences are required be submitted along with the bid.**
- 6) The applications not supported with requisite experience certificates, GST registration certificate, s no. and ITCC in Envelope-1 shall not be entertained
- 7) Solvency certificate for Rs. 72 lacs from any nationalized /scheduled bank. The applicant shall submit the solvency certificate, not older than six months prior to 30<sup>th</sup> June 2023, issued by any scheduled bank, in original.
- 8) Average Annual Turnover over HVAC works should be at least Rs 180 lacs during immediate last 3 consecutive financial years ending 31<sup>st</sup> Mar 2023.
- 9) Should not have incurred any loss in the more than two years in the last five years ending 31<sup>st</sup> Mar 2023.
- 10) Company should not have been barred / blacklisted for taking up similar work in any organization- A certification to this effect on the letter head of the bidder.
- 11) Performance certificates must be submitted by the vendors for the works.
- 12) Bidder shall furnish list of the supervisory persons and other technical persons he wishes to deploy in this job along with their experience details.
- 13) Letter of Authority for signing and negotiation of bid.
- 14) The 2<sup>nd</sup> **envelope** shall contain the financial bids including Priced Schedule of Quantities, Form of Tender, Conditions of Tender, Articles of Agreement, Brief Specifications, Condition of contract, Drawings all duly signed by the authorized signatory of the firms.

All these envelopes are to be put in a single envelope duly super-scribed the name of work, and addressed to CE, (IIITD) and with their address. In case the tenderer does not fulfill the laid down eligibility criteria or fails to deposit the earnest money in prescribed form, financial bid shall not be opened.

Tenderers shall seal the tender affix their initials and put stamp on each and every page of tender document before submission. The tender of the contractor, who submits in-complete tender document or submits more than one tender for one work, shall not be considered at all.

Tenders will be received by the **CE up to 3.00 P.M on 24.07.2023** and will be opened by him or his authorized representative in the office of Registrar, IIITD on the same day at **3.45 P.M.**

First the Technical Bids will be opened and screened. The bids shall be examined whether the EMD is in order and the bidder meets the minimum eligibility criteria specified above. . Those bidders whose EMD is in order, meets the minimum eligibility criteria, has submitted all the required documents and meet the technical requirements shall be considered for opening of financial bid. Conditional tenders would not be accepted. Financial bids in respect of contractors who do not fulfill above criterion shall not be opened.

15) No Xerox / certified copies of tenders shall be accepted, if submitted these tenders shall be rejected.

16) **Pre- bid meeting** - A pre bid meeting will be held as on **13<sup>th</sup> July 2023** at 11.00 AM - Any doubts or queries of the potential bidders will be addressed during the meeting. Venue: 5<sup>th</sup> floor, Board Room, Academic Block, IIIT-Delhi.

**CE**

## CONDITIONS

1. The time allowed for carrying out the construction work will be 6 months from the 7<sup>th</sup> day after the date of written orders to commence the work.
2. The site for the work is available.
3. During execution of works, because of some unforeseen circumstances to enable him to complete the work as per terms of the contract, shall not relieve the contractor from any liability or obligations under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the contractor, his agents or workmen.
4. The Contractor shall be required to deposit an amount equal to 3% of the tendered value of the work as performance guarantee in the form of an irrevocable bank guarantee bond of any scheduled bank or State Bank of India in accordance with the form prescribed or in the form of fixed deposit receipt etc. within 15 days of the issue of letter of acceptance. The performance guarantee shall have the validity up to 31st Jan 2024.
5. Tenderers are advised to inspect and examine the site and its surrounding at their own cost and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risk, contingencies and other circumstances which may influence or affect their tender. A tenderer shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed. The tenderer shall be responsible for arranging and maintaining at own cost all materials, tools and plants, water, electricity, access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specification of the work to be done, local condition and other factors having a bearing on the execution of the work.
6. The Accepting Authority (IIITD) does not bind himself to accept the lowest or any other tender and reserves to him/herself the authority to reject in whole or part, any or all of the tenders received without the assignment of any reason. All tenders in which any of the prescribed conditions are not fulfilled or for any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.

7. Canvassing, whether directly or indirectly, in connection with tenders is strictly prohibited and the tenders submitted by the contractor who resort to canvassing will be liable to rejection.
8. The Accepting Authority reserves to himself the right of accepting the whole or any part of the tender and the tender shall be bound to perform the same at the rates quoted.
9. Tenders shall remain open for acceptance for a period of 60 days from the date of opening of the tenders. If any tenderer withdraws his tender before the said period for issue of letter of acceptance, whichever is earlier or makes any modification in the terms and condition of the tender which are not acceptable to the IIITD, then IIITD shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money absolutely besides black listing of the tenderer.
10. The notice-inviting tender shall form a part of the contract document. The successful tenderer/contractor shall, sign the necessary contract documents consisting of the notice inviting tender, all the documents including additional conditions, specification and drawings, if any forming the tender as issued at the time of invitation of tender and acceptance thereof with any correspondence leading thereto within the time specified in the letter communicating the acceptance of the tender. In case of delay, the earnest money may be forfeited and the tender cancelled or the contract enforced as per the terms of the tender and the invitation to tender and the tenderer shall thus be bound by the condition of contract even though the formal agreement has not been executed and signed within the specified time by the tenderer.
11. The work shall be carried out as per general of conditions of contract for central PWD works 7/8 (Tender Contract) and form part of the agreement/document.
12. Contract is liable to be terminated by the IIITD without payment of any compensation, if subsequent to the acceptance of tender the contractor is black-listed by, or enters into partnership or employs any black listed contractor of the IIITD or any other department, or Govt. or its, undertakings.
13. Cost of Bidding
  - 13.1 The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.
14. Clarification of Bidding Documents
  - 14.1** A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing/mail at the Employer's address indicated in the invitation to bid not later than 3 days before the Date of Submission of Tenders. Email- [admin-project@iiitd.ac.in](mailto:admin-project@iiitd.ac.in) phone- **01126907563/64/65**

15. Currencies of Bid and Payment

- 15.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees. All payments will be invariably made in Indian Currency (Indian Rupees.)

16. PROTECTION OF ENVIRONMENT AND OTHER LAWS:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

During continuance of the contract, the contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and other local Acts/ Laws/ rules made there under, regulations, notifications and bye-laws of local authorities or any other law, bye-laws, regulations that may be passed or notification that may be issued in this respect in future by the State/ Local authority.

For and on behalf of the  
REGISTRAR  
Indraprastha Institute of Information Technology,  
New Delhi



**TENDER**

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

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

We agree to keep the tender open for one hundred twenty (120) days from the due date of its opening and not to make any modifications in its terms and condition.

A sum of Rs..... Rupees

.....)

has been deposited in demand draft of a scheduled bank issued by a scheduled bank as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said Director, IIITD or his successors in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that Director, IIITD or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, up to maximum of the percentage mentioned in Schedule ' F ' and those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form. Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / we shall treat the tender documents drawings and other records connected with the work as secret / confidential documents and shall no communicate information / derived there from to any person other than a person to whom I / we am / are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Dated. ....

Witness:

Address:

Signatures of Contractor

Postal Address

Occupation:

**LETTER OF SUBMISSION**

The CE  
Indraprastha Institute of Information Technology, Delhi  
Okhla Phase-III  
(Behind Govind Puri Metro Station)  
New Delhi-110020.

I/We, the undersigned, have read and examined in detail, the HVAC specifications and all bidding documents and hereby declare that:

**Price and Validity**

1. All the rates quoted in our proposal are in accordance with the terms and conditions as specified in the bid document. All the prices and other terms and conditions of this proposal are valid for a period of 60 calendar days from the date of opening of bid.
2. We do hereby confirm that our bid prices include all taxes/levies/GST indicated separately.
3. We hereby declare that if any tax law is altered, we shall pay the same.
4. The quoted rates are inclusive of ESI , PF and Green Tax no extra on such heads would be payable on such account.

**Earnest Money**

We have enclosed EMD in the form of demand draft no....., dated.....favoring IIIT, Delhi payable at New Delhi issued / drawn on .....Bank for Rs.\_\_\_\_\_/ - (Rupees \_\_\_\_\_ Thousand only), as desired.

**Deviations**

We declare that all the works shall be performed strictly in accordance with the technical specifications and other tender conditions with no deviations.

**Qualifying Data**

We confirm that all information/data have been submitted as required in tender document.

We hereby declare that our proposal is made in good faith, without collusion for fraud and the information contained in the proposal is true and correct to the best of our knowledge and belief. I/We agree that in case any information is found to be incorrect the tender is liable to be rejected at any point of tendering process.

Bid submitted by us is properly sealed and prepared so as to prevent any subsequent alteration and replacement.

We understand that you are not bound to accept the lowest or any bid you may receive.

Thanking you,  
Yours faithfully,  
(Signature and seal of Tenderer with name, designation and contact no.)

**ACCEPTANCE**

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of Registrar, IIITD for a sum of

Rs. ----- (Rupees -----  
-----)

The documents referred to below shall form part of this contract Agreement:-

- NIT
- Performa for Agreement
- Additional conditions.
- Special conditions
- Schedule of Quantities &
- Drawings
- General conditions of contract for CPWD Works-2020 with up to date correction slip

For & on behalf of  
Registrar  
IIIT-D

Signature.

.....

Dated.....

Designation.....

## SCHEDULES

**SCHEDULE 'A'**

Schedule of quantities (Enclosed) : Enclosed

**SCHEDULE 'B'**

Schedule of materials to be issued to the contractor NIL

**SCHEDULE 'C'**

Tools and plants to be hired to the contractor NIL

**SCHEDULE 'D'**

Extra schedule for specific requirements/documents for the work, if any, NIL

**SCHEDULE 'E'**

Schedule of component *of* Cement, Steel, other materials, Labour etc. for price escalation. NIL

**CLAUSE 10 CC**

Component of Cement - expressed as percent of total value work, N / A

Component of Steel-expressed as percent *of* total work. N / A

Component of civil (except cement & steel) / Electrical construction Materials-expressed as percent of total value of work. N / A

Component of labour-expressed as per cent of total value *of* work. N / A

Component of P.O.L. - expressed as percent of total value work. N / A

**SCHEDULE 'F'**

Reference to General Conditions of contract.

**Name of Work: SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 1 x 240 TR & 1 X 165 TR WATER COOLED SCREW CHILLERS AND ALLIED WORKS AT IIITD CAMPUS OKHLA PHASE-III, NEW DELHI-110020**

Estimated cost of work: Rs.180 lacs

- i. Earnest money: Rs. 3,60,000/-
- ii. Performance Guarantee- The contractor, for due and faithful performance of the Contract, shall obtain and submit to the Owner such security of 3% of the Contract Value within 15 days after the receipt of the Letter of Acceptance, in the form of BG Performa as appendix to tender from a scheduled Bank /FD providing such security shall be subject to the approval of the Owner. The cost of complying with the requirement of this Clause shall be borne by the Contractor.

**Period of Validity of performance Bond**

The performance bond shall be valid as at Conditions Cl 4 and till the Contractor has executed and completed the Works in accordance with the Contract. This security shall be returned to the contractor within 14 days of the issue of the said Completion Certificate.

**Claim under Performance Security**

Prior to making a claim under the performance security the Owner shall, in every case, notify the Contractor stating the nature of the default in respect of which the claim is to be made.

**Security Deposit / Retention money** shall be Two and half percent (2.5%) of the value of executed works and will be deducted from each and every payment made to the contractor against running account bill submitted for the work done at site.

- iii. Defect Liability period 12 months from date of completion.
- iv. Liquidated damages In case of delay on account of reasons attributable to the Contractor Liquidated Damages shall be levied. The amount of Liquidated Damages payable by the Contractor to the Employer would be 0.25% of the value of order for each calendar day of delay subject to a maximum of 5% of the value of order after which Employer reserves the right to terminate the contract without prejudice to the rights of the Employer.

General Rules & Direction:

Officer inviting tender: Registrar (IIITD)

**Definitions**

2(v) Engineer-in-Charge	CE
2(viii) Accepting Authority	DIRECTOR, IIITD
2(x) Percentage on cost of materials and labour to cover all overheads and profits.	15%
2(xi) Standard Schedule of Rates	DSR-Latest
2(xii) Department	IIIT -D
9(ii) Standard CPWD contract Form	CPWD form 8 -2010 with up to date correction slips.

**Clause 1**

- |   |        |
|---|--------|
| (i) Time allowed for submission of Performance Guarantee From the date of issue of letter of acceptance | 4 days |
| (ii) Maximum allowable extension beyond the period (Provided in (I) above                               | 7days  |

**Clause 2**

Authority for fixing compensation under clause 2.	Director, IIITD
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**Clause 2A**

Whether clause 2A shall applicable	No
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**Clause 5**

Number of days from the date of issue of letter Acceptance for reckoning date of start	7 days
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Time allowed for construction	6 months
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**Clause 6, 6A**

Clause applicable - (6 or 6A)	Clause 6A
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**Clause 7**

Gross work to be done together with net payment /adjustment or advance for material collected, if any since the last such payment for being eligible to interim payment.	Rs 50 Lakhs.
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**Clause 10A**

List of testing equipment to be provided by the contractor at site lab.

As required

**Clause 10 B (ii)**

Whether Clauses 10B (ii) (iv) shall be applicable  
-----do-----10B(iii) -----

Yes  
No

**Clause 10CA Escalation**

**Not Applicable**

**Clause 10CC Escalation**

**Not Applicable**

**Clause 11**

Specification to be followed for execution of work

CPWD Specifications 2007,  
Part I & II with Up-to-date  
correction slips

General Specification for  
HVAC works -2017

**Clause 12**

Deviation limit beyond which clauses 12.2 & 12.3 shall  
Apply for building work

100%

**Clause 16**

Competent Authority for deciding reduced rates.

Director, IIITD

**Clause 17**

Contractor liable for Damages defects during  
maintenance period

Applicable

**Clause 18**

List of mandatory machinery, tools & plants to be  
deployed by the contractor at site

As per the site requirement.

**Clause 36(i)**

Requirement of Technical Representative (s)

As per requirement.

**Clause 25**

Arbitration Clause

As per special conditions

## SPECIAL CONDITIONS

1. In the event of the tender being submitted by a firm, it must be signed by a person duly authorized through a power of attorney issued by all the partners and a certified copy of the power of attorney should be enclosed with the forwarding letter or separately by each member thereof, or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power of attorney authorizing him to do so and such power of attorney shall be produced with the tender and it must disclose that the firm is registered under the Indian partnership Act.

Each and every signature given shall be separately witnessed. A Contractor or a contractor who himself / themselves has/have tendered or who may tender for the work shall not witness the tender of another person for the same work. Failure to observe this condition would render tenders of the contractors tendering as well as witnessing the tenders liable for summary rejection.

2. The conditions for item rate tender only will be applicable as given in general conditions of contract for central PWD works 2020. As mentioned there in also, in event no rate has been quoted for any items leaving space bolts in figure (s), word(s) and amount blank, it will be presumed that the contractor has included the cost of this/these item(s) in other item(s) and rate for such items will be considered as zero and work will be required to be executed accordingly.
3. Rates quoted as percentage below/above in the tender will be summarily rejected.
4. It must be understood that the work has to be completed as per the time provided in the contract and as such time is the essence of the contract.
5. The quantities furnished in the bills of quantities are only probable quantities liable to alternation by omission, deduction or addition, and it would be clearly understood that the contract is **not a lump sum contract** and the IITD do not, in any way, assure the tenderer or guarantee that the said probable quantities are correct or that the work would correspond thereto. Payments will be regulated on the actual quantities of work authorizedly done and measured at the accepted rates. No claims due to change in quantities (+ or -) will be entertained. The drawings, forming parts of complementary installations work specifications and the bills of quantities, of the contract, are explanatory of and are to one another, representing together the works / to be carried out. If neither the drawings nor the specifications nor the accepted bills of quantities include any part/parts the intention to include which is nevertheless clearly inferred and which are obviously necessary for the proper completion of the works/ installations, all such parts shall be supplied and executed by the contractor at no extra charge. Anything contained in one or another of (a) the drawings, (b) the specifications and (c) the accepted bills of quantities and not found in the others will be equally binding as if it were contained in each of them.



6. No alterations, which are made by the tenderer in the drawings, specifications, conditions or probable quantities accompanying this notice will be recognized and if any such alterations are made the tender, will be invalid. Conditional tenders will however be liable for rejection.
7. The tenderer must obtain for himself on his own responsibility and at his own expense all the information necessary, including risks, contingencies and other circumstances to enable him to make a proper tender and to enter into a contract with the IIITD. He must examine the drawings, specifications, conditions and so on and must inspect the site of work, examine the nature of the ground and the subsoil (so far as is practicable) and acquaint himself with local conditions, means of access to the work, storage facilities or areas for staff colony, the nature of the work, in fact all matters pertaining thereto before he submits his tender.
8. The tenderer shall also bear all expenses in connection with the preparation and submission of his tender and attendance for subsequent negotiations/clarifications.
  - (I) Omission, neglect or failure on the part of the tenderer to obtain requisite and reliable information on any matter affecting his tender, the contract and the construction, completion, maintenance, (dismantling and disposal) of the work shall not relieve the tenderer whose tender is accepted from any liability in respect of the contract.
  - (II) The tenderer whose tender is accepted shall not be entitled to make any claim for increase in the rates quoted and accepted excepting in pursuance of any specific provision in the contract.
9. The Contractor, upon award of work, shall furnish the following details for the approval of the Engineer in charge:
  - 9.1. The names of manufacturers of specialized items such as patented water proofing systems / materials, doors, flooring tiles, false ceilings, insulating materials, wind mill, cement, steel, glazing, and any other materials etc. which he proposes to use in the work.
  - 9.2. The makes and types of fittings, materials, subject to the makes and type stipulated in the specifications, which he proposes to use in the work.
  - 9.3. The details of licenses granted to him and/or to professional qualified and/or licensed technical personnel on his staff who will be engaged on the work (and submit, if called for, the licenses for inspection by the Officer in charge in consultation with Engineer in charge).
  - 9.4. Only approved agencies/ skilled workers shall be deployed to carry out requisite specialized items of work. The Officer/ Engineer in charge's decision in consultation with Architect's/ in this regard shall be binding to all the parties concerned.

10. The rates quoted in the bills of quantities shall unless specified otherwise will be for all heights, depths deemed to be for finished work in-situ/ item by item as provided for, and shall include cost for all necessary material and labours, all necessary tools and plants and machinery, sheds, marking out, clearing site, etc. and for all taxes, octroi, excise, VAT works contract and any other tax or duty levied by Government, Central or Local, or Local Authority, GST indicated separately ,if any as applicable.

10.1. The rates shall be firm and not be subject to any variations in exchange rates, in taxes, duties etc. in railway freight and the like including labour conditions, etc. The rates are not subject to escalation.

11. It will be the sole responsibility of the contractor to procure all the equipments/ materials and other materials required for the work.

13. The IIITD further reserves the right to delete or reduce at any time, any section of the bills of quantities with out assigning any reasons whatsoever there for and no claim will be entertained in this regard.

14. The tenderer whose tender is accepted is bound to execute formal agreement with the IIITD within one week of the date of intimation of award of work in accordance with the draft agreement which will include conditions of tender, form of tender (general conditions of contract for central PWD works 2020), Articles of Agreement, Bills of quantities, Conditions of contract, Special conditions if any, the drawings and specifications, but his liability under the contract shall commence from the date of written order to commence work whether the formal agreement is drawn or not.

The Contractor shall bear all expenses in connection with the execution of the said agreement including fees for stamping and registration of documents as required.

15. The Security Deposit will bear no interest what so ever until the date of release.

16. a) The contractor, upon award of work, shall submit a memorandum of procedure giving the outline of his general scheme, programme and time table, in the form of a chart that shall be scrutinized and approved (with modifications as necessary), which shall become the approved programme for execution. The approved programme shall be the basis for assessment of comparative progress under the relevant conditions of contract.

(b). Over and above, the contractor has to supply programme chalked out showing important milestones to be achieved and the progress actually achieved compared with, the target of the same in the programme and shortfall, if any planned for being made up in the programme for next month.

17. (a) The work in general shall conform to the CPWD Specifications 2007 with up to date correction slips & any other latest civil specification published by CPWD,

New Delhi and the "Specifications for works".

(b) In case items not covered by the general specifications referred above, reference shall be made to the appropriate I.S. Code.

(c) Should there be any difference in the particular specifications of individual item of work and the description of item as given in the Schedule of quantity, the latter shall prevail, which will be as per the relevant drawing.

(d), In case of any work for which there is no specification in I.S. specifications or in the specifications forming part of tender documents or in case there is any variation, such work shall be carried out in all respects in accordance with the instructions to be issued by the Engineer in charge.

18. On acceptance of the tender the Contractor shall in writing and at once inform the IITD and the Architects the name of his accredited representative(s) who will be responsible to take instructions from the Architects / Officer in Charge.

The work of any part of it shall not be transferred, assigned or sublet without the written consent of the IITD.

19. The Contractor shall be required to co-operate and work in co-ordination with and afford reasonable facilities for such other agencies / specialists / interior designers / consultants as may be employed by the Architects / Project Management Consultant/ Officer in Charge on other works / sub-works in connection with the project/scheme of which this work forms a part.
20. The Contractor shall get the necessary insurance done for their personal employed/ company insurance, third party insurance, marine insurance, all risk insurance or any other insurance as required.
21. The Contractor shall make arrangements of carrying water and electricity beyond one point where same shall be provided and recovery @1% of the cost of works shall be effected accordingly.
22. The Contractor is required to comply with all Acts of Government relating to labour, safety, environment and other Rules and Regulations made there under from time to time and to submit at the proper times all particulars and statements required to be furnished to the appropriate Authorities.

**23. Delay and extension of time**

If in the opinion of the Architect/PMC/Owner the Work is delayed:

- a) By force majeure, or
- b) By reason of any exceptionally inclement weather, or

c) By reason of proceedings taken or threatened by or dispute with adjoining or neighboring owners or public authorities arising otherwise than through the Contractor's own default, or

d) By the works or delays of other Contractor or tradesmen engaged or nominated by the Owner or the Architect/PMC and not referred to in the Schedule of Quantities and/or Specification, or

e) By reason of Architect's/PMC/Owner Instructions to delay work, or

f) By reason of civil commotion, local combination of workmen or strike or lock-out affecting any of the building traders, or

g) In consequence of the Contractor not having received in due time necessary Instructions from the Architect/PMC/Owner for which he shall have specifically applied in writing,

Then the Architect/PMC/Owner shall make a fair and reasonable extension of time for completion of the Contract Work; in case of such strike or lock-out the Contractor shall, as soon as may be, give written notice thereof to the Architect/PMC/Owner, but the Contractor shall nevertheless constantly use his endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Architect to proceed with the work.

24. Failure by Contractor to comply with Architect's Instructions

If the Contractor after receipt of written notice from the Architect requiring compliance fails within ten days to comply with such further drawings and/or Architect's Instructions the Owner with the consent of the Architect may employ and pay other persons to execute any such work whatsoever that may be necessary to give effect thereto, and all costs incurred in connection therewith shall be recoverable from the Contractor.

**25. Termination or Abridgment of Contract by the Owner**

a) If the Contractor being an individual or a Firm commit any 'Act or Insolvency' or shall be adjudged an Insolvent or being an Incorporated Company or Society shall have an order for compulsory winding up made against it or pass an effective resolution for winding up voluntarily or subject to the supervision of the Court and of the Official Assignee of the Liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him requiring him to do so, to show to the reasonable satisfaction of the Architect that he is able to carry out and fulfill the Contract, and to give security therefore, if so required by the Architect, or

b) If the Contractor (whether an individual, Firm, Incorporated Company or Society) shall suffer execution to be issued, or

- c) Shall suffer any payment under this Contract to be attached by or on behalf of any or the creditors of the Contractor, or
  - d) Shall assign or sublet this Contract without the consent in writing of the Architect/PMC first obtained, or
  - e) Shall charge or encumber this Contract or any payments due or which may become due to the Contractor there under, or
  - f) If the Architect/PMC shall certify in writing to the Owner that the Contractor:
    - i) Has abandoned the Contract, or
    - ii) Has failed to commence the works, or has without any lawful excuse under these Conditions suspended the progress of the works for 14 days after receiving from the Architect/PMC/Owner written notice to proceed, or
    - iii) Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or
    - iv) Has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Architect written notice the said materials or work were condemned and rejected by the Architect under these conditions, or
    - v) Has neglected or failed persistently to observe and perform all or any of the acts, matters or things by this Contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or
    - vi) Has to the detriment of good workmanship or in defiance of the Architect's/PMC Instructions to the contrary sub-let any part of the Contract,
26. Then and in any of the said cases the Owner with the written consent of the Architect/PMC may, notwithstanding any previous waiver, after giving seven days' notice in writing to the Contractor, determine the Contract, but without hereby affecting the powers of the Architect or the obligations and liabilities of the Contract the whole of which shall continue in force as fully as if the Contract had not been so determined and as if the works subsequently executed had been executed by or on behalf of the Contractor. The costs of these works are therefore recoverable from the Contractor. And further, the Owner under instructions of the Architect, by his Agents or servants may enter upon and take possession of the works and all plants, tools, scaffolding, sheds, machinery, steam and other power utensils and materials lying upon the premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the works or by employing any other Contractor or other person or persons to complete the Work, and the

- Contractor shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other Contractor or other person or persons employed for completing and finishing or using the materials and plant for the Work. When the Work shall be completed or as soon thereafter as convenient the Architect shall give a notice in writing to the Contractor to remove his surplus materials and plant, and should the Contractor fail to do so within a period of 14 days after receipt thereof by him, Owner shall sell the same, and shall give credit to the Contractor for the amount realized. The Architect shall thereafter ascertain and certify in writing what (if anything) shall be due or payable to or by the Owner for the value of the said plant and materials so taken possession of by the Owner and the expense or loss which the Owner shall have been put to in procuring the works to be completed, and the amount, if any, owing to the Contractor and the amount which shall be so certified shall thereupon be paid by the Owner to the Contractor or by the Contractor to the Owner, as the case may be, and the certificate of the Architect shall be final and conclusive between the parties.
27. If at any time after the commencement of the work the Owner shall for any reason whatsoever not require the whole thereof, as specified in the tender, to be carried out, but need to abridge the Contract, the Owner shall give notice in writing of the fact to the Contractor who shall have no claim to any payment or compensation which he might have derived from the execution of the work in full, but which he did not derive in consequence of the whole amount of the work not having been carried out. The Contractor shall in this case, however, be entitled to payment for the work already executed by him in accordance with the agreed rates. The Owner shall also take over all building materials as might have been ordered for the work, but orders for which cannot be canceled, if delivered within a reasonable time, and shall pay for them at cost price. The Contractor shall also be allowed to remove his tools and plants from the site.
28. Termination of Contract by Contractor
- a) If payment of the amount payable by the Owner under Certificate of the Architect /PMC for beyond two months from date of issue of certificate due to reason not attributable to the contractor.
  - b) The Owner commits any 'Act of Insolvency', or
  - c) If the Owner (being an individual, or firm) shall be adjudged an Insolvent, or (being an Incorporated Company or Society) shall have an order made against him or pass an effective resolution for winding up, either compulsorily or subject to the supervision of the Court or voluntarily, or if the Official Assignee or the Owner shall repudiate the contract, or if the Official Assignee or the Liquidator in any such winding up shall be unable within fifteen days after notice to him requiring him so to do, to show to the reasonable satisfaction of the Contractor that he is able to carry out and fulfill the Contract and to make all payments due, and to become due there under and, if required by the Contractor, to give security of the same, or

d) If the works be stopped for three months or more under a continuous spell under the order of the Architect /PMC or the Owner or by any injunction or other order of any Court of Law,

29. Then and in any of the above said (Clause28) cases the Contractor shall be at liberty to determine the Contract by notice in writing to the Owner, through the Architect, and he shall be entitled to recover from the Owner payment for all works executed and cost of the material supplied and lying at site for the purpose of the Contract as on the said day of the termination. No other claim for idle labour, loss of overheads, profits shall be entertained nor shall any other claim on account of the delay in completion of the work /availability of site/unwarranted conditions whatsoever shall be tenable, even if it is caused by circumstances beyond the Contractor's control.

### **30. Procedure for Settlement of Disputes**

#### **30.1 Engineer's Decision**

If a dispute of any kind whatsoever arises between IIIT-Delhi and the contractor in connection with, or arising out of, the contract or the execution of the works, whether during the execution of the works or after their completion and whether before or after any repudiation or other termination of the contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the engineer, the matter in dispute shall, in the first place, be referred in writing to the engineer, with a copy to all parties. Such reference shall be made within one (1) month of arising of any such dispute and state that it is made pursuant to this clause. No later than one (1) month after the day on which he received such reference the engineer shall give notice of his decision to IIIT-Delhi and the contractor. Such decision shall state that it is made pursuant to the reference under this clause.

Unless the contract has already been repudiated or terminated, the contractor shall in every case, continue to proceed with the works with all due diligence and the contractor and IIIT-Delhi shall give effect forthwith to any / every such decision of the engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award. If either IIIT-Delhi or the contractor be dissatisfied with any decision of the engineer, or if the engineer fails to give notice of his decision on or before one (1) month after the day on which he received the reference, then either IIIT-Delhi or the contractor may within a further period of one (1) month from the day on which it / they receive(s) the notice of such decision, or on the day on which the said period of notice of / for decision expired, as the case may be, give notice to the other party, with copy for information to the engineer, of its / their intention to commence arbitration. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and no arbitration in respect thereof may be commenced unless such notice is given. If the engineer has given notice of his decision as to a matter in dispute to IIIT-Delhi and the contractor and

no notification of intention to commence arbitration as to such dispute has been given by either IIIT-Delhi or the contractor as herein provided, the said decision shall become final and binding upon IIIT-Delhi and the contractor.

### **30.2. Amicable Settlement**

Where notice of intention to commence arbitration as to a dispute has been given in accordance with sub-clause 22.1, arbitration of such dispute shall not be commenced unless an attempt has first been made by the parties to settle such dispute amicably. Provided that, unless the parties otherwise agree, arbitration may be commenced on or after one (1) month from the day on which notice of intention to commence arbitration of such dispute was given, whether or not any attempt at amicable settlement thereof has been made or result achieved.

### **30.3. Arbitration**

Any dispute in respect of which:

- a) the decision, if any, of the engineer has not become final and binding pursuant to the first sub-clause above,
- b) amicable settlement has not been reached within the period stated in the second sub-clause above,

shall be finally settled, unless otherwise specified in the contract, by arbitration to be held in New Delhi in English, under the provisions of the Arbitration and Conciliation Act 1996, including any statutory reenactment(s) / amendment(s) thereof and Rules made thereunder, by the arbitrator. The Director of the Institute shall appoint one person as the sole arbitrator. Either party shall be limited in the proceeding before such arbitrator to evidence or arguments put before the engineer for the purposes of obtaining the said decision pursuant to the first sub-clause herein. No such decision shall disqualify the engineer from being called as a witness and giving evidence before the arbitrator on any matter whatsoever relevant to the dispute. Arbitration proceedings shall not be commenced prior to the completion of the works, unless any major pre-requisite criticality is discerned by the arbitrator, and the obligations of IIIT-Delhi, the engineer and the contractor shall not be altered by reason of the arbitration. The works shall not be stopped on account of the said process of arbitration and the contractor shall not be relieved of his responsibilities for the completion of the work under any circumstances whatsoever.

### **31.2. Contractor to provide everything necessary**

The Contractor shall provide everything necessary for the proper execution of the Work according to the intent and meaning of the Drawings, Schedule of Quantities and Specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from, and if the Contractor finds any discrepancy in the Drawings or between the Drawings, Schedule of Quantities and Specification he shall immediately and in writing refer the same to the Architect who shall decide which is to be followed.



**31.3. Materials and Workmanship to conform to Descriptions**

All materials and workmanship shall so far as procurable be of the respective kinds described in the Schedule of Quantities and/or Specification and in accordance with the Architect's Instructions, and the Contractor shall upon the request of the Architect furnish him with all invoices, accounts, receipts and other vouchers to prove that the materials comply therewith. The Contractor shall at his own cost arrange for and/or carry out any test of any materials which the Architect may require.

**31.4. Assignment and Sub-letting**

The whole of the works included in the Contract shall be executed by the Contractor and the Contractor shall not directly or indirectly transfer, assign or underlet the Contract or any part share thereof or interest therein without the written consent of the Architect, and no undertaking shall relieve the Contractor from the full and entire responsibility of the Contract or from active superintendence of the Work during its progress.

**31.5. Removal of improper work**

The Architect shall, during the progress of the Work, have the power to order the removal, from the Site or works within such reasonable time or times as may be specified in the order, of any materials which in the opinion of the Architect are not in accordance with the Specification or the Instructions of the Architect, the substitution of proper materials, and the removal and proper re-execution of any works executed with materials or workmanship not in accordance with the Drawings, Specifications or Instructions and the Contractor shall forthwith carry out such order at his own cost. In case of default on the part of the Contractor to carry out such order, the Owner shall have the power to employ and pay other persons to carry out the same, and all expenses consumed thereon or incidental thereto as certified by the Architect shall be borne by the Contractor, or may be deducted by the Owner from any moneys due or that may become due to the Contractor.

31.6 Site visit is mandatory and all dimensions etc as available in the plant rooms must be seen prior to the tender submission. An Undertaking to this effect must be submitted. **Annexure - XX**

31.7 Please note that IIITD is a research based University and the chillers will be used for the same. The necessary documentation for the chillers custom duty reduction based on the certificate required will be supplied by the IIITD. The Contractor will have to refund the exempted amount of custom duty with all documentary evidence to the IIITD for verification.

### **ADDITIONAL CONDITIONS**

1. General conditions of contract for Central PWD Works 7/8 (Tender of Form) shall be part of the agreement.
2. The work shall be carried out strictly as per CPWD specifications 2007, Part I & II with up to date correction slips. Wherever no specification is available in the above said document, drawings and specifications supplied with bill of quantities shall be applicable
3. The Contractor shall have to clear the site for the work of all overlying rubbish /garbage/dumped refuse material prior to commencement of the work in case required at no extra cost. The contractor shall take approval from the Engineer /Officer in Charge in writing for collection and stacking of materials.
4. The contractor must follow CPWD Safety Code as provided in general conditions of contract for CPWD Works.
5. Any damage done by the contractor or his workmen to any existing work during the course of execution of the work shall be made good by him at his own cost.
6. Contractor shall clear the site thoroughly of all rubbish etc. left out of his materials immediately on completion of the work and properly keep the site clean around the building to the satisfaction of the Engineer- in-Charge.
7. The preference of the codes will be IS codes.
8. The rates are inclusive of all staging, material and labour as required for the works. The items in the bill of quantities include all the materials, labour, and installation, complete as a finish items unless otherwise stated.
9. Unless specifically mentioned otherwise, quoted Rates shall be deemed to include work to be carried out at all curvatures, heights, depths, inclinations and locations, and in wet/foul locations, as and when they are encountered. The rates quoted for the various works as specified in the Priced Schedule of Quantities are work in all types of soils/rock and prevailing Site conditions including earth work, excavation, shoring, execution of various other items of work, i.e., laying of pipes, joining, concreting, masonry, plastering, etc. in and under water and dewatering as required. Nothing extra is payable on this account.
10. All security precautions shall be taken during dismantling work. The site shall be fenced /barricaded with suitable material during construction period .No payment shall be made for fencing/barricading work. Fencing/barricading shall be done immediately after possession of site and shall be removed after completion of construction period
11. No space on site/otherwise for labour huts shall be provided by IITD, cost of same shall be borne by contractor.

12. The general condition of contract for Central P.W.D. Works has reference of various laws /acts /rules. The settlement of any disputes and arbitration, only Indian arbitration and conciliation act 1996 shall be applicable.
13. In case any specific brand of material has been specified either the same brand or of approved make of same specifications shall be used. The contractor shall take approval in advance for all such materials.
14. Costs for all materials and labour for the preparation of samples, market research, etc. shall be borne by the Contractor within his quoted Rates and nothing extra shall be payable for this. The works shall not be proceeded with without approval of the sample. In case sample is rejected and works cannot be proceeded with the IITD shall be at liberty to terminate the contract and the Contractor shall have no claim for the works under such circumstances whatsoever.
15. The contractor should take utmost care to avoid any damage to the existing flooring, electrical works/cables, telephone cables, false ceiling, sprinkler system, fire alarm etc. in place. In case of any damage, it would be the responsibility of the contractor to restore the same immediately.
16. The contractor may have to carry out the works in odd hours of day and night as per academic schedule of the Institute and no extra charges shall be payable.
17. The works may have to be suspended from time to time as per academic requirements. No extras/escalation will be payable except for suitable extension of time of upto time as per GCC of the CPWD.
18. All protocols/guidelines for preventing spread of Covid 19/ Cov2 SARS virus strains need to be followed by the Contractor/s as per Govt . / IITD authorities Guidelines issued from time to time.
19. Necessary guidelines for Environmental Protection as per local /State Govt/ Central Govt Authorities as applicable shall be followed by the Contractor/s. Extension of time will be granted as justified without any financial implications.
20. All works are to be carried out in coordination with the other agencies at work and the time period of noisy work has to be in coordination with the academic calendar/requirements. Noisy work should be done at night hours only. Other agencies for works may work simultaneously or separately as required for the allowed periods of time as required by them for the smooth completion of the works.

**CORRIGENDUM TO FORM 7/ 8 / 9 (CPWD) MUST BE READ ALONG WITH THE PAMPHLET**

S.No	FOR	READ
1	Government of India/Owner	Indraprastha Institute of Information Technology Delhi
2	C.P.W.D. or Government or Department	Indraprastha Institute of Information Technology Delhi
3	CPWD -7/8/9	CPWD 7/8/9
4	President / President of India	Chairman ,BOG,IIITD
5	Chief-Engineer	Director ,IIITD
6	Superintending Engineer	CE, IIITD
7	Administration Head	Registrar ,IIITD
8	CPWD Code, Paragraph '90	Shall be applicable to IIITD works
9	DSR 2021	Shall be applicable to IIITD works
10	CPWD specifications 2007 part - I& II	Shall be applicable to IIITD works
11	DSR (Internal) 2022 for Electrical works	Shall be applicable to IIITD works
12	CPWD specifications (Internal) 2013 for Electrical works	Shall be applicable to IIITD works
13	DSR External 2022 for Electrical works and specifications	Shall be applicable to IIITD works
14	Provision of Section 12 Sub-Section (i) of the works man compensation	Shall be applicable to IIITD works
15	CPWD safety Code framed from time to time	Shall be applicable to IIITD works
16	CPWD maternity benefits to labour	Shall be applicable to IIITD works
17	Model Rules of the protection of health and sanitary appointment for workers employed by CPWD	Shall be applicable to IIITD works
18	CPWD contractor labour Regulations	Shall be applicable to IIITD works

## SPECIFICATIONS:

### 1. GENERAL:

1.1. Without forgoing the requirements of the conditions of Tender and the Conditions of Contract the works in general shall conform to the "Specifications 2007" published by CPWD, New Delhi and the "Specifications for works" stated in this tender. In case items not covered by the general specifications referred above, reference shall be made to the appropriate I.S. Codes. If there is any difference in the particular specifications of individual item of work and the description of item as given in the Schedule of quantity, the latter shall prevail. In case of any work for which there is no specification in I.S. specifications in the specifications forming part of tender documents or in case there is any variation, such work shall be carried out in all respects in accordance with the instructions to be issued by the Engineer-in-charge. The term Officer in Charge appearing in the specifications shall mean supervisor and be in Charge of the work or his authorized representative as the context may demand. All corrections to "Specifications 2007" or latest revisions of I.S. Code/ Specification shall be deemed to apply to this contract.

1.1.1. Materials bearing ISI certification mark certification shall be given highest preference for use in the works. Where the Contractor is required to do, perform, execute (etc.) any work or service or the like, it shall be deemed to be at his own cost. Absence of terms providing, Supplying, installing, fixing, etc. shall not even remotely entitle the Contractor to any additional payment there for

1.1.2. The rates accepted in the Schedule of Quantities apply to all floors, heights, depths, leads, lifts, spans, sizes, shapes, locations, etc. unless a distinction has been included in the very Schedule.

1.1.3. The Specifications and the Schedules may have been divided into various sub-heads for convenience only. This does not limit applicability of one to the other nor does it absolve the Contractor of his responsibility to complete any trade / item of work as reasonably inferred from one or more of such sub-heads.

1.1.4. The Schedule of Quantities is not necessarily based on "Schedule of Rates - Delhi 2007 or any of its later/ earlier versions. Hence the Schedule of Quantities shall be read and construed according to explanations given herein and intentions gathered there from. A mere parallel drawn from the said Schedule of Rates shall therefore not form a basis for a variation and, or additional payment.

1.1.5. All work under this contract is deemed to be performed above subs soil water level. However, removal of water collected from rains and the like shall be treated as part of contractual risk/obligation.

- 1.1.6. Screws, bolts, nuts, washers, hold fasts, lugs, anchors, clamps, plugs, suspenders, brackets, straps and fasteners of the like are deemed to be included in the rates of various items unless the Schedule of Quantities expressed a different intention.
- 1.1.7. Resetting any displacements, making good holes/chases and such other incidental jobs are included in rates of respective items for which these are required.

## **2. DRAWINGS, SPECIFICATIONS, INTERPRETATIONS ETC.:**

In general, drawings shall indicate the dimensions, positions and type of construction, the specifications shall stipulate the qualities and the methods and performance criteria, and the schedule of quantities shall indicate the provisional quantities and the rates for each item of work. However, the above documents being complementary, what is called for by any one shall be as binding as if called for by all. In case of contradictory requirements between specifications and schedule of quantities, the requirements given in the schedule of quantities shall prevail.

Special conditions being mainly an amplification of General Conditions, they shall be read in conjunction with each other.

Work indicated on the drawings and not mentioned in the schedule of quantities or specifications or vice versa, shall be deemed as though fully set forth in each. Work not specifically detailed, called for, marked or specified, shall be the same as similar parts that are detailed, marked or specified.

### **I.S. SAFETY CODES**

I.S.660 Safety Code for Mechanical Refrigeration

I.S.659 Safety Code for air conditioning

I.S.3016 Code of Practice for precautions in welding and cutting operations

I.S.818 Code of practice for safety and health requirements in electrical and gas welding and cutting operations.

I.S.5216 Code for safety procedure and practice in electrical works

I.S.3696 Safety code for scaffolds and ladders

**Special Note**

**Though every care is taken while preparing this document to cover all necessary matters, specifications, general conditions, special conditions, provisions for smooth and complete execution of work, however in case of any omission in the tender/ contract document, latest correction slips of general conditions of contract for CPWD works 2020 will be the reference manual but not in supersession to aforesaid conditions.**

Contractor should depute a qualified supervisor dedicated for this work, who will monitor and coordinate work from contractor's side and interact with the IIITD Engineers, responsible for supervision of work, on regular basis.

Contractor will take due permission for entry of all his workers in IIITD. No unauthorized person will be allowed to work inside. During execution of work, Engineer may make minor changes in the scope of work as per site conditions or other reasons. Contractor will have no extra claim in his rates for the same.

All standard protocols such as wearing masks, using sanitizer, maintaining safe distancing norms must be followed by the Contractor and his workers to prevent spread of coronavirus failing which expulsion/ penalty shall be levied on the agency. The workers shall be scanned for temperature before entry as per norms and actions per policy taken.

All are supposed to use identified utilities of the Institute only

**I. GENERAL**

**1. INTRODUCTION**

The Tender call for Adding chillers at New Ac plant room and old plant room at Indraprastha Institute of Information Technology, Okhla Ph-3, Delhi.

Following are items Added in the System.

1x240TR Chiller adding in New AC Plant Room.

1x165TR Chiller adding in Old Ac Plant Room.

1No. Chilled water Pumps in Old AC Plant room. (Only ITC of pumps in vendor’s scope).

1No. Condenser water Pumps in Old AC Plant room. (Only ITC of pumps in vendor’s scope).

**2. RELATED DOCUMENTS**

These Specifications shall be read in conjunction with the General conditions of contract, schedule of work, drawings and other documents connected with the work.

**3. TERMINOLOGY**

The definition of terms used in these specifications shall be in accordance with IS: 3615-"Glossary of terms used in refrigeration and air-conditioning".

**4. COLOUR SCHEME FOR THE EQUIPMENTS AND COMPONENTS**

- Color scheme for equipment like chilling unit, pumps, cooling tower etc. shall be as per manufacturer’s standard colour scheme.
- The scheme of color code painting of pipe work services for air conditioning installation shall be as per National building code and is indicated below:-

<b>Description</b>	<b>Ground Colour</b>	<b>Lettering Colour</b>	<b>First Colour band</b>
Condenser water piping	Sea Green	Black	French Blue
Chilled water piping	Sea Green	Black	Black
Central heating piping below 60°C	Sea Green	Black	Canary Yellow
Central heating piping 60°C to 100°C	Sea Green	Black	Dark Violet
Drain Pipe	Black	White	
Vent	White	Black	
Valves and pipe line fittings	White with Black Handles	Black	
Belt guard	Black & Yellow diagonal strips		
Machine bases, Inertia Base Plinth	Charcoal grey		



- Color bands shall be 150mm wide, superimposed on ground color to distinguish type and condition of fluids. The spacing of band shall not exceed 4.0m.
- In addition to the color bands specified above all pipe work shall be legibly marked with black or white letters to indicate the type of service and the direction of flow identified as follows:
  - Chilled water : CHW
  - Condenser water : CDW
  - Condensate : C

## **II. WATER CHILLING UNIT WITH VFD (SCREW TYPE)**

### **1. SCOPE**

Supply, Installation, Testing & Commissioning of factory assembled single piece water-cooled liquid chiller with unit mounted VFD (Variable Frequency Drive) starter. Contained within the unit shall be unit mounted VFD, factory wiring, piping, controls, refrigerant charge (HFC-134a), refrigeration circuit, semi hermetic screw compressor, electronic expansion valves and equipment required prior to field start-up. Sound pressure level at 1 meter distance for 100% load should not exceed 84 dbA in case of VFD chiller as per AHRI Standard 575 without any tolerance, Computer generated acoustic report shall also be furnished along with the chiller selection sheet.

### **2. SCREW CHILLERS**

The screw chilling machine with single/Multi compressor with single/Multi circuit shall consist of horizontal, semi-hermetic, direct driven low speed helical rotary compressors with screw, refrigerant cooled motor, oil separator, evaporator, water cooled condenser, factory mounted microprocessor-based panel & VFD, interconnecting refrigerant piping, electronic expansion valve, controls and accessories to make it compact & efficient unit.

The compressor should have capacity control from 20% to 100%, making it suitable for varying load applications and efficient under part load conditions. The cost of VFD is to be included in the cost of unit. The Unit shall be refrigerant suction gas cooled so that the windings of semi- hermetic compressors is within limits i.e. during part operation when the suction gas is less, as an abundant precaution, liquid refrigerant is injected to the suction side of the compressor to cool the motor winding.

- 2.1 The screw compressor shall have a rotary mono/twin rotary screw, and may be of open / Semi hermetic type. It shall be using refrigerant R134a.
- 2.2 The mono/twin rotary screw shall be manufactured from forged steel. The profile of screws shall permit safe operation upto a speed of 5000 RPM for 50 Hz

operation. The compressor shall unload from fully loaded to the minimum capacity by means of hydraulically actuated slide valve positioned over the screw rotor.

- 2.3 The compressor housing shall be of high-grade cast iron, machined with precision, to provide a very close tolerance between the rotor(s) and the housing.
- 2.4 The rotor(s) shall be mounted on antifriction bearings designed to reduce friction and power input. There shall be multiple cylindrical bearings to handle the radial and axial loads.
- 2.5 There shall be built in oil reservoir to ensure full supply of lubricants to all bearings and a check valve to prevent backspin during shut down.
- 2.6 There shall be oil pump or other means of differential pressure inside the compressor for forced lubrication of all parts during startup, running and during shut down. An oil sump header shall be provided.
- 2.7 The open type compressor shall also have a suitable shaft seal, to prevent leakage of refrigerant.
- 2.8 The driving motor shall be squirrel cage type Semi hermetic/ Open type as required, protected against damage by means of built in protection devices.

### 3. **COMPRESSOR:**

Unit shall have semi-hermetic VFD driven mono/twin-screw compressors with internal relief valve and check valve to avoid reverse rotation on shut down. Each compressor shall be equipped with a discharge shut-off valve. The discharge shall also be equipped with a muffler to reduce discharge gas pulsations. Step less Capacity control shall be provided, capable of reducing compressor capacity down to 25% of full load. Motor shall be cooled by suction gas and protected by internal winding temperature sensors. Compressor bearings shall be designed for minimum 73000 hours at maximum operating conditions. Lubrication oil system shall include pre-filter and external filter capable of filtration to 5 microns.

#### 3.1 **Compressor motor**

The electrical motor driving the compressor shall be squirrel cage induction motor class 'F' insulation, Open dip proof for open type unit and totally enclosed (refrigerant cooled) for hermetic/ semi-hermetic unit.

- i) The motor shall be suitable for VFD operation on  $415 \pm 10\%$  volts, 3 phase, 50 HZ alternating current supply, unless otherwise specified.
- ii) The motor synchronous speed shall not exceed 3000 r.p.m.

- iii) Continuous BHP rating of the motor shall not be less than the maximum power requirement of the compressor and drive under specified design conditions

### 3.2 **Motor starter**

The VFD shall be mounted on the main electrical control panel / unit mounted/ self mounted as specified. The starter for the motor shall be VFD. VFD shall be rated for intermittent duty.

The following protective devices will be factory mounted and wired to the starter:

- a) 3-leg sensing electronic overloads with indicating lights and reset button
- b) Phase rotation protection circuit and indicating light
- c) Single-phase failure protection circuit and indicating light
- d) High temperature safety protection system with indicating light and reset button
- e) Hinged access door with lock and
- f) High and low line voltage protection.

The following convenience items will be factory mounted and wired to the starter:

- a) Auxiliary 1-1/2 KVA transformer
- b) Digital Elapsed Time Meter
- c) Power Fault Protection , Electrical lugs
- d) 3-phase digital ammeter and digital voltmeter readout via control panel, KW Meter, KWh Meter & Ammeter
- e) Voltmeter Elapsed Time Meter

### 4. **EVAPORATOR**

Unit shall be equipped with a single evaporator. Evaporator shall be manufactured, tested and stamped in accordance with ASME/GB Pressure Vessel Code. The maximum refrigerant-side operating pressure will be 2100 kPa, and the maximum waterside pressure will be 1000 kPa. The evaporator shall be mechanically cleanable, shell-and-tube type with removable heads. Tubes shall be internally and externally grooved, seamless-copper, and shall be rolled into tube sheets. Shell shall be insulated with 19 mm closed-cell foam with a maximum K factor of 0.28. Evaporator thermal insulation shall be factory fitted. The evaporator shall have a drain and vent in each head. The evaporator shall incorporate an active refrigerant level control system to ensure optimum heat transfer performance under all load conditions. Design shall incorporate one refrigerant circuit. Chiller shall have only one water inlet & outlet connection with Victaulic couplings to avoid vibrations transmission and accept small misalignment. Evaporator shall be fitted with electronic auto setting water flow switch. Paddle switches or differential pressure switches shall not be acceptable. The chiller shall be of flooded type.

#### 4.1 MATERIAL AND CONSTRUCTION

- i) The water chiller shall be horizontal, shell end tube type, designed, constructed and tested for the refrigerant specified in the tender specifications.
- ii) The chiller shall be designed for a working pressure on the refrigerant side suitable for the refrigerant offered, and on the water side for 10 kg./sq.cm. gauge.
- iii) The end plates of chiller shall be made of MS of thickness not less than 25mm.
- iv) The shell of the chiller shall be made of MS of thickness not less than 8 mm with electric fusion welded seams.
- v) The tubes shall be of seamless, hard drawn copper with a minimum tube wall thickness of 0.71 mm for plain tubes & minimum 0.63mm at the root of fins.
- vi) The tubes may be either plain or internally finned as per manufacturer's design.
- 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 spacing not less than 1250 mm to prevent sagging / vibration of tubes.
- ix) The chiller shall be smooth finished with one coat of paint as per manufacturing practice before the insulation is applied.
- x) The chiller shall be sand blasted from both inside (before insertion of tubes) & outside.
- xi) Sight glass to check the level of refrigerant

#### 4.2 CONNECTIONS AND ACCESSORIES

The chiller shall be provided with the following connections and accessories and conforming to section "Refrigeration Piping" where applicable

- i) Refrigeration inlet and 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 valves
- vii) Water inlet and outlet connections
- viii) Proper oil return system
- ix) Flow switch/pressure switch/differential flow switch/ flow sensor in the water line(s)

#### 4.3 PRESSURE TESTING

- i) The chiller shall be tested in the works to 1.5 times the maximum working pressure or 21 kg/sqcm (Pneumatic), whichever is higher.
- ii) The water side of the chiller shall also be tested to a hydraulic pressure of 10 kg/sqcm at the works.  
Pressure test certificates shall be produced in respect of each chiller

### 5. CONDENSER

Unit shall be equipped with a single condenser. Condenser shall be manufactured, tested and stamped in accordance with ASME/GB Code. The maximum refrigerant-side operating pressure will be 2100 kPa, and the maximum waterside pressure will be 1000 kPa. The condenser shall be mechanically cleanable shell-and-tube type with removable heads. Tubes shall be internally and externally grooved, seamless-copper, and shall be rolled into tube sheets. Design shall incorporate one refrigerant circuit and the oil separator. The condenser shall have a drain and vent in each head. Chiller shall have only one water inlet & outlet connection with victaulic couplings to avoid vibrations transmission and accept small misalignment.

#### 5.1 MATERIAL AND CONSTRUCTION

- 1 The condenser shall be horizontal, shell and tube type, designed, constructed and tested for the refrigerant specified in the tender specifications.
- 2 The shell of the condenser shall be made of MS of thickness not less than 8mm, with electric fusion welded seams. 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.
- 3 The end plates of condenser shall be made of MS of thickness not less than 25mm.
- 4 The condenser shall be designed for a working pressure on the refrigerant side suitable for the refrigerant offered, and on the water side for 10 kg/sqcm gauge.
- 5 The tubes shall be of seamless hard drawn copper and finned, unless otherwise specified.
- 6 The minimum wall thickness shall be 1.0 mm with root thickness of 0.63 mm below the fins.

- 7 Intermediate tube supports of steel shall be provided at no more than 1250 mm intervals to prevent sagging and vibration of the tubes. The condensers shall have marine water boxes designed for multi pass flow.
- 8 The tubes may be provided with special tabulating arrangement to improve heat transfer where such an arrangement is a standard design of the manufacturer.
- 9 The condensers 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. It should be possible to descale the tubes without disconnecting the water line connections, wherever marine water boxes have been specified in the tender documents.
- 10 The condenser shall be provided with baffle arrangement for preventing direct impingement of hot gas over the tubes and to enable even distribution of the gas over the tube bundles.
- 11 The condenser shall include necessary provision for sub-cooling of the refrigerant where the refrigerating 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.
- 12 The condenser shall be sand blasted from both inside & outside.

## 5.2 CONNECTIONS AND ACCESSORIES

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

- i. Hot gas inlet and liquid outlet connections. The liquid line connections shall be provided with isolating valves.
- ii. Water inlet and outlet connections.
- iii. Pressure relief device.
- iv. Drain connection with valve for water side.
- v. Differential flow switch/ pressure switch/ flow switch/ flow sensor in the water line(s)

## 5.3 PRESSURE TESTING

- 1 The condenser shall be tested at the works to 1.5 times the maximum working pressure or 15 kg/sq.cm. (Pneumatic) whichever is higher.
- 2 The water side of the condenser shall also be tested to a hydraulic pressure of 10 kg./sq.cm. in the works.
- 3 Pressure test certificates shall be produced in respect of each condenser.

## 6. REFRIGERATION CIRCUIT

Refrigerant circuit components shall include, compressor, oil separator, high and low side pressure relief devices, compressor discharge and liquid line shutoff valves, refrigerant economizer, filter driers, moisture indicating sight glasses, long

stroke electronic expansion device, and complete operating charge of both refrigerant HFC-134a and compressor oil.

To facilitate service and maintenance and avoid refrigerant charge transfers, it must be possible to isolate the following components and systems independently: filter driers, oil filters, expansion devices and compressor.

- 6.1 Refrigerant piping shall be designed and installed so as to:
  - i) Ensure circulation of adequate refrigerant at all loads.
  - ii) Ensure oil return to crank case of compressor positively and continuously.
  - iii) Keep pressure losses within limits, especially in suction lines.
  - iv) Prevent oil/liquid refrigerant from entering the compressor when the compressor is working as well as when it has stopped.
  - v) Prevent trapping of oil in evaporator or suction lines, which may return to the compressor in the form of slug.
- 6.2 Hot gas lines: Oil shall be entrained and carried by hot gas under all load conditions likely to be encountered in normal operation.
- 6.3 Liquid Lines:
  - i) Liquid lines shall be designed to ensure that flashing of liquid refrigerant does not occur by minimizing the pressure drop suitably, by avoiding long vertical risers, and appropriate sub cooling.
  - ii) Each liquid line shall be provided with a permanently installed refrigerant drier of throw away or rechargeable type. The drier shall be installed in a valved line.
  - iii) Flow indicator (moisture indicating type) shall be installed on all liquid lines.
- 6.4 Suction Lines:
  - a) Oil shall be entrained and carried by the suction gas under all conditions of load likely to be encountered in normal operation.
  - b) Piping shall be designed for a suitable velocity of refrigerant (similar to hot gas line) to ensure that oil will not separate from the gas and drain to the compressor in slugs.
  - c) The refrigeration system shall be equipped with controls for pump down system so that the evaporator and suction line are emptied before the compressor shuts off, thus preventing liquid refrigerant and oil from entering the compressor when restarted.
  - d) Refrigerant lines shall be sized to limit pressure drop between evaporator and condensing unit to less than 0.2 kg. per sq.cm. (3 psi).
- 6.5 Isolating valve shall be provided to enable isolation of each compressor in case of multiple compressor units (as built in valves), strainer, drier and any other components as may be required for proper operation and maintenance.
- 6.5.1 Thermostatic expansion valve/float valve shall be provided in refrigerant circuit.
- 6.6 MATERIAL

- i) Refrigerant plumbing for chilling machine shall be of mild steel or wrought iron/copper to manufacturer's standards.
- ii) Fittings like bends, tees, sockets etc. shall be of wrought copper or forged brass and shall be suitable for the duty involved. Flare type compression fittings of forged brass shall be allowed upto 15 mm piping size. Tubes upto and including 15mm size may be bent to form 90 degree bends with inside radius not less than 3tube dia. For bigger sizes, bend fittings as mentioned above must be used.
- iii) Where specified in the tender specification, mild steel may be provided for refrigeration piping, with seamless MS tubes and fittings of heavy class conforming to IS: 1239. All liquid lines and instruments lines shall however be of copper only.
- iv) Valves shall be of the packed, back-seating type for both copper and MS refrigerant plumbing work, and these shall be of forged or cast brass construction.

**6.7 PRESSURE TESTING**

After completion of the piping installation, the entire chilling unit shall be pressure tested with dry nitrogen or any other inert gas at the following pressures for the particular refrigerant to be used:

Test pressure (Kg./Sq.cm. (Gauge))	
High pressure side	Low pressure side
20	8

This test shall be carried out as follows:

- i) The system shall be charged with nitrogen or inert gas to 1.0 Kg./sq.cm. gauge and all joints shall be checked for leakage with a mixture of four part water, one part liquid soap and a small amount of glycerin. Leaks shall be marked, pressure released and repairs done. Brazed joints, which leak, shall be opened and redone. These shall not be repaired by addition of brazing alloy to the joints.
- ii) The system shall now be charged with nitrogen or the inert gas to the pressure specified in the above table and the process of locating leaks and repairs shall be repeated.

Final pressure test: After all the leaks have been repaired, the system shall be retested with the test pressure maintained for a period of not less than 8 hours. No measurable drop in pressure should be detected after the pressure readings are adjusted for temperature changes. Pressure Gauges, controls and compressors may be valved off during pressure testing.

**7. MICROPROCESSOR CONTROLLER**



Unit controls shall include as a minimum: microprocessor with non-volatile memory, picture guided unit/operator interface, the LOCAL/OFF/REMOTE/CCN selector and a touch-screen display with multiple language capability.

Pressure sensors shall be installed to measure suction, discharge, and oil pressure.

Thermistors shall be installed to measure cooler entering and leaving temperatures (on cooler and condenser side).

Unit shall be capable of performing the following functions: Automatic change-over and cycling of compressors to equalize running hours and number of starts.

EXV control, based on throttling optimizes evaporator charging, ensuring condenser superheat and sub cooling.

Capacity control based on leaving chilled fluid temperature with return fluid temperature sensing.

Limit the chilled fluid temperature pull-down rate at start-up to an adjustable range of 0.1°C to 1.1°C per minute to prevent excessive demand spikes at start-up. Enable reset of leaving chilled water temperature according to the return water temperature or by means of a 0-10V signal.

Provide a dual set point for the leaving chilled water temperature activated by a remote contact closure signal or by the built in time clock.

Enable a 2-level demand limit control (between 0 and 100%) or a maximum current drawn limit activated by a remote contact closure or by the built in time clock.

Control evaporator water pump, safety pumps (if installed) and the condenser pump.

Allow two time scheduling programs to enable unit start-up control, demand limit and set-point changes.

Enable lead lag control of two chillers running in series or parallel.

- 7.1 Each chilling unit shall be complete with a microprocessor based interactive control console in a locked enclosure factory mounted (directly on the unit), prewired with all operating and safety controls and tested.
- 7.2 It will provide start, stop, safety, interlock, capacity control and indications for operation of the chiller units through alphanumeric/graphical display.
- 7.3 Controls shall provide to view and change digital programmable essential set points, cause of shutdown and type of restart required.
  - i) Leaving chilled water temperature
  - ii) Percent current limit
  - iii) Remote reset temperature range

- 7.4 All safety and cycling shutdowns shall be enunciated through the alphanumeric/graphical display and consist of day, time, cause of shutdown and type of restart required.
- 7.5 Cycling shutdown shall include low leaving chilled water temperature, chiller/condenser water flow interruption, power fault, internal time clock and anti-recycle.
- 7.6 Safety shutdowns shall include low oil pressure, high compressor discharge temperature, low evaporator pressure, motor controller fault and sensors malfunction.
- 7.7 The default display screen shall indicate the following minimum information
- i) Date and time
  - ii) Return and leaving chilled water temperatures
  - iii) Return and leaving condenser water temperatures
  - iv) Differential oil pressure
  - v) Percent motor rated current
  - vi) Evaporator & condenser refrigerant saturation temperatures
  - vii) Chiller operating hours (hour run) and
  - viii) Number of compressor starts
  - ix) Oil sump temperature
  - x) Status message
- 7.8 Security access shall be provided to prevent unauthorized change of set points, to allow local or remote control of the chiller and to allow manual operation of the perforation vanes and oil pump.
- 7.9 The chiller shall be provided with ports compatible with any building management system offered, to output all system operating information, shutdown/cycling message and a record of last four cycling or safety shutdowns to a remote printer (option) . The control centre shall be programmable to provide data logs to the printer at a set time interval.
- 7.10 Control centre shall be able to interface with an automatic control system to provide remote chiller Start/stop; reset of chilled water temperature, reset of current limit, and status messages indicating chiller is ready to start, chiller is operating, chiller is shut down on a safety requiring reset and chiller is shut down on a recycling safety.
- 7.11 The microprocessor control system shall include the interlocking of compressor motor with chilled and condenser water flows, guide vane position of compressor in case of centrifugal units and lubricating oil pump pressure.

- 7.12 On initiation of start, the microprocessor control system shall check all pre-start safeties to verify that all prestart safeties are within limits. (If one is not, an indication of the fault will be displayed and the start aborted).

## 8. **DIAGNOSTICS**

Display module shall be capable of displaying set points, system status including temperatures, pressures, current for each compressor, run time and percent loading.

The control system shall allow a quick test of all machine elements to verify the correct operation of every switch, circuit breaker, contactor etc. before the chiller is started.

## 9. **SAFETIES**

Unit shall be equipped with all necessary components, and in conjunction with the control system shall provide the unit with protection against the following:

- Reverse rotation.
- Low chilled water temperature.
- Low oil pressure (per compressor).
- Current imbalance.
- Compressor thermal overload
- Automatic compressor unloading in case of excessive condensing temperature
- High pressure.
- Electrical overload.
- Loss of phase.

Control shall provide separate general alert (minor incident) and alarm (circuit down) remote indication.

## 10. **ELECTRICAL CHARACTERISTICS**

Unit shall operate on 3-phase power supply without neutral. Control voltage shall be supplied by a factory-installed transformer. Unit shall be supplied with factory-installed electrical disconnect/isolator switch integrating main fuses. Unit shall have a factory installed star/delta starter as standard to limit electrical inrush current.

## 11. CERTIFICATION

The Rotary Screw Chilling machine must be ARI certified.

## 12. Chiller Factory performance test (At factory on AHRI Certified Test bed)

The complete unit shall be factory tested at 100% capacity at design Condition and witnessed by Representatives of the Department/Consultant or as given in bid document for performance at the rated conditions by simulating the actual design conditions.

One unit of each capacity shall be tested. All controls and switchgear shall be tested for proper functioning and set of design values.

The capacity in TR / kcal/hr shall be calculated from measurements of temperature difference and flow rate of water, in condenser and chiller. The power consumption shall be checked from current measurement of the motor. All calculated and checked results shall match the specified data within tolerances as stipulated by AHRI. All instruments and personnel for tests shall be provided by the contractor.

Contractor shall inform the client about the chiller testing schedule min. 10 to 15 days before the chiller is ready for factory testing.

## III. On-line Non-chemical scale prevention system

### TECHNICAL SPECIFICATIONS

#### **Scale prevention system**

**System:** Non-chemical water treatment system should prevent the formation of hard scale in cooling circuits of air conditioning equipment.

**Core:** The inner core should be able to convert the hardness salts into colloidal particles.

**Electricity:** The unit should not require any electricity or any other source of energy.

**Maintenance Cost:** The unit should not have any recurring, operating and maintenance cost

**Model / Size:** The size of the unit shall be determined based on the water quality and water flow rate.

**Installation:** The unit shall be installed in the condenser water circuit/ Chiller circuit

**Outer Casting:** stainless steel, steel grade 304

#### **Components of Scale prevention system Treatment System**

- The equipment is in the shape of a pipe, the length and the diameter vary for different model
- The outer casing pipe is made of stainless steel, seamless quality to avoid corrosion.
- There is a special core fitted inside, which is made of an alloy, having varied polarity

- The core consists of turbulent bars able to create eddy currents.
- It is a non-chemical equipment and does not require any chemicals.
- It has a single component without any moving parts.
- Each Scale prevention system unit comes with flanges, fitted on both ends. 2 extra flanges are also provided along with the unit.

#### **IV. WATER PLUMBING WORK**

##### **1. SCOPE**

This chapter covers the requirements of plumbing work in chilled water, hot water, water in condenser circuit and drains, to be executed as part of heating, ventilating and air conditioning.

##### **2. PLUMBING DESIGN**

Pipe sizes shown in tender documents are purely for contractor's guidance. The contractor shall be responsible for selection of sizes as per detailed engineering to be done by him. Plumbing design to be done by the Air-conditioning contractor shall conform to the following: -

- i) Water velocity in pipes shall not exceed 2.5 m/sec.
- ii) Butterfly/ Ball valves shall be provided at
  - a) Suction and delivery sides of pumps.
  - b) Inlet and outlet of each condenser, chiller, cooling tower, hot water regenerator.
  - c) All drain connections from equipment's.
- iii) Non return valve shall be provided at the delivery of each pump. This shall be of swing type.
- iv) Balancing valve shall be provided at the outlet side of chiller, condenser, heating and cooling coils to regulate the maximum flow rate upto value preset as desired.
- v) Balancing valves shall be provided, where specified, for AHU's to regulate the maximum flow rate upto a value preset as desired. A mercury manometer shall be supplied with every 10 nos. or part thereof of balancing valves, whether or not specifically indicated in the tender specifications.
- vi) Air valves shall be provided at all high points in the piping system for venting with a size of 25 mm for pipes upto 100 mm and 40 mm for larger pipes.
- vii) Plumbing drawings showing the sizes of valves, layout and other details shall be prepared and shall be got approved from the Engineer-in-Charge before the execution of the plumbing work.

**3. PIPE MATERIALS**

Pipes shall be of the following materials.

- (i) Mild steel medium class (Black steel) tube conforming to IS: 1239 for sizes upto 150 mm.
- (ii) Welded black steel pipe, class 2, conforming to IS: 3589, for sizes greater than 150 mm. These pipes shall be factory rolled & fabricated from minimum 6mm thick M.S. Sheet for pipes upto 350mm dia & from minimum 7mm thick M.S. sheet for pipes of 400mm dia & above.

**4. PIPE JOINTS**

Seismic considerations shall be taken into account while planning joint details. Joints in black steel pipes shall be of any of the following types.

- (i) Screwed joints and union joints screwed to pipes, upto 25 mm size.
- (ii) Butt welded joints for pipe sizes above 25mm. Electric welding shall be used for sizes 100mm and above.
- (iii) Flanges joints with flanges as per IS: 6392 for all sizes. Flanges may be steel welded neck type or slip on type welded to pipe, or alternatively screwed type. The item of flanges shall be measured and paid separately.
- (iv) Flexible coupling V groove joints.
- (v) Flexible connections shall be provided at the pumps, and other machine where requires as per following specifications-
  - a) The Flexible connections shall be flanged type expansion joint. Flanges shall be non-compressible and mechanically strong type and the Neoprene rubber shall be provided in between the flange ends.
  - b) The connections shall work for a temperature range of minus 10°C to 70°C.
  - c) The length and working pressure of bellows shall be as follows:

Nominal Bore(mm)	Length (mm)	Pressure(Bar)
20 -25	125	15
32 -200	150	15
250 -350	200	10

- d) Connections shall be provided with control rods to control the excessive elongation or compression of piping systems.
- e) These shall be capable to withstand torsional movement upto 3° without damage.

**5. VALVES**

- i) The material of butter fly valves shall be as under: Body- Cast iron Disc- Cast Bronze or Stainless Steel Seat- Either integral or Nitrile rubber O-ring- Nitrile/ Silicon
- ii) Balancing valve shall be of cast iron flanged construction with EPDM/SG iron with epoxy coated disc with built in pressure drop measuring facility (pressure test cocks) to compute flow rate across the valve. The test cocks shall be long enough to protrude out of pipe insulation.
- iii) Non return valves shall be of gun metal construction upto 65 mm, the metal conforming to class 2 of IS: 778. For 75 mm and above, the valve shall be of bronze or gun metal, body being of cast iron. While screwed or flanged ends may be provided upto 65 mm, flanged ends shall be provided for larger sizes.
- iv) Air valves shall be of gunmetal body.

## 6. **STRAINERS**

- (i) Strainers shall be of 'Y' type or pot type as specified.
- (ii) 'Y' strainers shall be provided on the inlet side of each air-handling unit and pump in chilled water and condenser water circuit.
- (iii) Pot strainers, where specified, shall be provided in return water headers, for chilled water and condenser water if enough floor area is available in the refrigeration plant room, as an alternate to individual Y type strainers with pumps.
- (iv) The strainers shall be designed to the test pressure specified for the gate valves.
- (v) Filtration area of Y-strainer shall be minimum four times the connecting pipe size.
- (vi) Strainers shall have a removable bronze/ stainless steel minimum 1mm thick screen with 3 mm perforations and permanent magnet.
- (vii) Strainers shall be provided with flanges or threaded sockets as required. They shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of screen without disconnection of the main pipe.

- (viii) Strainers shall be provided with equal size isolating gate valves on either side so that the strainers may be cleaned without draining the system.
- (ix) Pot strainer shall be fabricated out of MS sheet and the sizes shall be as under:-

<b>Pipe sizes (mm)</b>	<b>Pot dia (mm)</b>	<b>Pot Height (mm)</b>	<b>Basket dia (mm)</b>	<b>Basket Height (mm)</b>
50	300	400	200	240
80	350	450	250	250
100	450	500	300	280
125	500	600	330	340
150	540	700	360	390
200	610	815	400	470
250	800	955	550	510
300	1000	1105	750	580
350	1190	1300	895	678
400	1350	1500	1020	785
450	1518	1700	1060	890
500	1690	1800	1100	900

## 7. INSTRUMENTS

- i) Pressure gauge of appropriate range and 150 mm. dial size shall be provided at the following locations.
  - a) Supply and return of all heat exchange equipments.
  - b) Suction and discharge of all pump sets. The pressure gauge shall be duly calibrated before installation and shall be complete with shut off cocks.
- ii) Direct reading industrial type thermometer of appropriate range shall be provided at the inlet and outlet of all heat exchange equipments. The thermometers shall be installed in separate wells.
- iii) Appropriate number of additional sockets shall be provided for the installation of pressure & temperature transducers for BMS.

## 8. INSTALLATION

- i) The installation work shall be carried out in accordance with the detailed drawings prepared by the Air-conditioning Contractor and approved by the Engineer-in-charge.



- ii) Air-conditioning contractor shall utilize the structural provisions for Air-conditioning services wherever provided by the Department in the building and make his own arrangements for additional changes.
- iii) Expansion loops or joints shall be provided to take care of expansion or contraction of pipes due to temperature changes.
- iv) Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.
- v) Wherever reducers are to be made in horizontal runs, eccentric reducers shall be used if the piping is to drain freely, in other locations, concentric reducers may be used.
- vi) Open ends of piping shall be blocked as soon as the pipe is installed to avoid entrance of foreign matter.
- vii) All pipes using screwed fittings shall be accurately cut to the required size and threaded in accordance with IS: 554 and burs removed before laying.
- viii) Piping installation shall be supported on or suspended from structure adequately. The Air-conditioning contractor shall design all brackets, saddles, clamps, hangers etc. and shall be responsible for their structure integrity.
- ix) Pipe supports, preferably floor mounted shall be of steel, adjustable for height and prime-coated with zinc chromate paint and finish-coated gray. Spacing of pipe supports shall not be more than that specified below: -
- x)

<b>Nominal Pipe size (mm)</b>	<b>Spacing (Metres)</b>
12 and 15	1.25
20 and 25	2.00
32, 40, 50 and 65	2.50
80, 100 and 125	2.50
150 and above	3.00

Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stress on the pipes. Pipe hangers shall be fixed on

walls and ceiling by means of metallic or rawl plugs or approved shear fasteners.

- xi) Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation.
- xii) Anti vibration pads, springs or liners of resilient and non-deteriorating, material shall be provided at each support, so as to prevent transmission of vibration through the supports.
- xiii) Pipe sleeves of diameter larger than the pipe by least 50 mm shall be provided wherever pipes pass through walls and the annular spaces shall be filled with felt and finished with retaining rings.
- xiv) Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars attached to pipe with a 12mm thick rubber pad or any other resilient material as approved by the Engineer-in-charge.
- xv) The space in the floor cut outs around the pipe work (after insulation work where applicable) shall be closed using cement concrete (1:2:4mix) or steel sheet, from the fire safety considerations, taking care to see that a small annular space is left around the pipes to prevent transmission of vibration to the structure.
- xv) Riser shall have suitable supports at the lowest point.
- xvi) Where pipes are to be buried under ground, the top of the pipes shall be not less than 75 cms. from the ground level. Where this is not practicable, permission of the Engineer-in-charge shall be obtained for burying the pipes at lesser depth. The pipes shall be surrounded on all sides by sand cushion of not less than 15 cms. After the pipes have been laid and top sand cushion provided, the trench shall be refilled with the excavated soil and any extra soil shall be removed from the site of work by the Air conditioning contractors.
- xvii) All pipes and their steel supports shall be thoroughly cleaned and given one primer coat of Zinc chromate before being installed.
- xviii) After all the water piping has been installed, pressure tested in accordance with clause 10.10, all exposed piping in the plant rooms shall be given two

finish coats of paint, approved by the Engineer-in- Charge. Similar painting work shall be done over insulated pipe work, valves etc. The direction of flow of fluid in the pipes shall be indicated with identifying arrows.

- xix) 3 mm gasket shall be used for flanged joints.
- xx) Cut-outs in floor slabs shall be sealed with cement concrete or steel plate after the plumbing work is done, from the fire safety point of view.

## 9. **PRESSURE TESTING**

- (i) All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg./sq.cm. for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge.
- (ii) Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.
- (iii) System may be tested in sections and such sections shall be securely capped.
- (iv) It shall be made sure that proper noiseless circulation is achieved through all the coils and other heat exchange equipments in the system. If proper circulation is not achieved due to air-bound connections, the contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification, including the tearing up and refinishing of floors, walls, etc. as required.
- (v) Insulation shall be applied to piping only after the completion of the pressure testing to the satisfaction of the Engineer-in-charge.
- (vi) Pressure gauges may be capped off during pressure testing of the installation.
- (vii) The contractor shall provide all materials, tools, equipments, instruments, services and labour required to perform the tests and to remove water resulting from cleaning after testing.

## 10. **BALANCING**

- i) After completion of the installation, all water system shall be adjusted and balanced to first minimize throttling losses; then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Exceptions to above:
  - a) Where Variable frequency Drives are used as starter & capacity control.
  - b) Impellers need not to be trimmed nor pump speed adjusted for pumps with pump motors of 7.5 kW (10 hp) or less,
  - c) Impellers need not to be trimmed when throttling results in no greater than 5% of the nameplate horsepower draw, or 2.2 kW (3hp), whichever is greater.
- ii) Automatic control valves (Pressure Independent Balancing cum Control Valve) and three way diverting valves shall be set for full flow condition during balancing procedure. Water circuit shall be adjusted by balancing cocks provided for balancing. These shall be permanently marked after the balancing is completed so that they can be restored to their correct positions, if disturbed.

## 11. **MEASUREMENT**

Measurements of plumbing work shall be on following basis: -

- a) Piping shall be measured along the centre line of installed pipes including all pipe fittings and accessories but excluding valves and other items for which quantities are specifically indicated in the schedule of work. No separate payment shall be made for fittings and accessories.
- b) The rates for piping work shall include all wastage allowances, pipe supports, hangers, nuts and check nuts, vibration isolators, suspension where specified or required, and any other item required to complete the piping installation. None of these items will be separately measured nor paid for.
- c) Piping measurement shall be taken before application of the insulation in the case of insulated pipe work.

## V **INSULATION WORK**

### 1. **SCOPE**

This chapter covers the requirements of thermal insulation for chilled water / hot water piping, pumps.

## 2. MATERIAL-TYPES

The insulation material to be used for various applications shall be any of the following, as required:

- i) For insulation of water piping, pumps and tanks: -
  - a) Expanded polystyrene (T.F. Quality)
  - b) Resin bonded glass wool
  - c) Polyvinyl Nitrile (Closed cell rubber foam)
  - d) XLPE (Closed cell cross linked polyolefin foam)

Expanded polystyrene (T.F. Quality) shall be used for pipe insulation like inside the A.C. plant room, exposed to outside or buried in ground. In the case of expanded polystyrene (TF quality), Resin bonded glass wool the pipe insulation should be in rigid sections in two halves and preformed to fit snugly on to pipes (upto pipe sizes for which the preformed sections are manufactured by the manufacturer of insulation). For higher pipe sizes insulation slabs shall be used.

Resin bonded glass wool is to be used for piping inside the building due to its fire retardant properties, for considerations of fire safety. Polyvinyl Nitrile (Closed cell rubber foam) available in tube shapes for sliding on to the small dia. pipes can be used if successfully tested for fire retardant properties.

However, all shall need to be covered with vapour barrier and cladding with aluminium sheet.

- ii) For Insulation of duct work: -
  - a) Resin bonded glass wool.
  - (b) Polyvinyl Nitrile (Closed cell rubber foam)
- iii) For acoustic lining of duct work and AHU rooms: -
  - (a) Resin bonded glass wool.
  - (b) Resin bonded mineral wool.
- iv) For suction line, Chilled water pipe and Chiller insulation: -
  - (a) Expanded Polysterene (T.F. Quality)
  - (b) Polyvinyl Nitrile (Closed cell rubber foam)
- (v) For double skin AHUs:
  - (a) Polyurethane foam (PUF insulation)

**3. INSULATION THICKNESS**

The thickness of insulation shall be as indicated below unless specified otherwise in the tender specifications.

- i) For pipe insulation (for chilled water as well as hot water application

<b>Pipe Size (mm) (mm)</b>	<b>Glass fibre /Exp. Polystyrene</b>
150 & below	50
Above 150	75

**4. APPLICATION OF INSULATION ON PIPES (including suction line insulation)**

- (i) The surface to be insulated shall be first cleaned and a coat of zinc chromate primer shall be given. The insulation shall be fixed tightly to the surface with cold setting adhesive CPRX compound. All joints shall be staggered and sealed. The second layer of insulation wherever required shall be similarly applied over the first layer.
- (ii) Pipes shall be preferably pre insulated at factory, meeting the requirement or the insulation shall be finished at site as under:
  - (a) For pipes laid inside the building, the insulation over the pipe work shall be finished with 0.63 mm thick aluminium sheet cladding over a vapour barrier of 120 gm/ sq.m. polythene sheet with 50 mm overlap and tied down with lacing wire and complete with type 3, grade-I roofing felt strip (as per IS 1322 as amended upto date) at the joints.
  - (b) For pipes outside the building laid above ground the finishing over the pipe insulation shall be finished with 0.63 mm G S sheet cladding over a vapour barrier of 120 gm/sq.m polythene sheet with 50mm overlap and tied down with lacing wire and complete with type 3 grade I roofing felt strip applied by means of cold setting CPRX compound..
  - (c) For pipes outside the building laid under ground the insulation shall be covered with 500 gauge polythene faced hessian, (the polythene facing outwards), with 50 mm overlap. All joints shall be sealed with bitumen. A layer of 0.50 mm x 20 mm G.I. wire mesh netting shall be provided over it butting all joints and it shall be laced down with GI wire, sand cement plaster (1:4) 20 mm. thick shall be provided in 2 layers of each 10mm and shall be water proofed by applying hot bitumen & fixing tar felt over the plaster. It shall be finally finished with a coat of hot bitumen.) In case of factory pre insulated pipes, buried underground, a water leakage

sensing wire shall also be provided, to detect the location of water leakage at later date.

- (d) In case of factory pre insulated pipes, all joints shall be properly insulated at site as per recommendation of manufacturer
- (iii) All valves, fittings, strainers etc. shall be insulated to the same thickness and in the same manner as for the respective piping, taking care to allow operation of valves without damaging the insulation.

## 5. **APPLICATION OF INSULATION ON PUMPS**

Expanded polystyrene (TF quality) 50mm thickness shall be sandwiched between two aluminium sheets of 0.5mm thickness and properly clamped to pump in two semicircular sections.

## 6. **MEASUREMENT OF INSULATION**

- a) Pipe insulation shall be measured in units of length along the centre line of the insulated pipe. The linear measurements shall be taken before the application of the insulation. For piping measurements, all valves, orifice plates and strainers shall be considered strictly by linear measurement along the centre line of the pipes, and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.
- b) Duct insulation and acoustic lining shall be measured on the basis of surface area along the outer surface (ref IS14164 of 2008) of insulation thickness. Thus the surface area of externally thermal insulated or acoustically lined duct shall be based on the perimeter at the centre of thickness of insulation, multiplied by the centre-line length of ducting including tapered pieces, bends, tees, branches etc. as measured for bare ducting. In the case of tapering pieces, their average perimeter shall be considered.

## **VI TESTS AT SITE/WORKS**

### 1. **GENERAL**

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the Architect/ Consultants/ Owner representative, site engineer-in-charge in accordance with the provisions of the applicable ASHRAE standards or approved equal and furnish necessary test certificates from manufacturers at the time of delivery of requirement at site.

## 2. INITIAL INSPECTION AT MANUFACTURER'S WORKS

### 2.1 Centrifugal Compressor

- Salient features such as model capacity control, type of lubrication etc. shall be verified against the requirements visually without opening the compressors.
- Manufacturer's internal test certificates shall be scrutinized to check compliance with the requirements as specified in the contract.
- Free running test shall be carried out at the speed for which the motor is available with manufacturer but the speed shall not be than that specified in contract. This test shall be carried out for minutes in open space. During this running test following operations are to be noted:
  - Manual operation of capacity control
  - Lubrication oil pressure
- Pneumatic test pressure test at 21 Kgf/sq.cm for casing of compressor
- Vacuum test for the compressor for 0.5mm

### 2.2 Condensers

- Salient features like number of tubes, inside diameter of tubes (from which the gauge of the tube can be verified), no. of passes, material of fins, length of condenser, provision of fittings like safety valve, water, gas connection shall be verified during stage inspection. The tube thickness shall be checked.
- Manufacturer's internal test certificates shall be furnished and it shall be verified against contract requirements.
- Pneumatic pressure test at twice the normal condensing pressure for gas side of condenser shall be carried out.
- Hydraulic test at 10Kgf/ sqcm for water side of the condenser shall be carried out.

### 2.3 Chiller

- Salient features like type of chiller, number and inside diameter of tubes (from which gauge of the tubes can be verified), material of tubes, type, material and the number of fins, wherever applicable, diameter and length of chiller and provision of fittings be verified against requirements specified in the contract during stage inspection. Tube thickness shall be checked.
- Manufacturer's internal test certificate shall be furnished and same shall be checked as per contract requirements.
- Pneumatic pressure test at twice the normal condensing pressure for gas side of condenser shall be carried out.
- Hydraulic test at 10Kgf/sqcm for the water side of chiller shall be carried out.

### 2.4 Chilling Unit (Water Cooled only)

Full load test shall be carried out to verify the capacity and IKW/ Ton. Note: In case of imported centrifugal chilling machine, initial inspection shall be carried out at site before installation in respect of items needing physical inspection and



verification. No tests shall be done at manufacturer's works. The test certificates for all the specified tests shall be produced which shall be accepted if found in order.

3.

**3.1 Pumps**

- Salient features such as model and make shall be checked as per contract requirements.
- The manufacturer's test certificates with Sr. No., head, discharge will be furnished and verified against contract requirements.

**3.2 Pipes and Valves**

- It should be checked that the same is as per makes specified in contract
- Dimensions including weight shall be checked for pipes against the requirements contract.

**3.3 Insulation and Acoustic Lining**

- Physical verification for thickness and make should be made as per contract before application of insulation.
- Manufacturer's test certificate for density should be furnished. Note: Accuracy of testing instruments shall be as mentioned in the final inspection procedure.

**4. FINAL INSPECTION**

4.1 After completion of the entire installation as per specification in all respects, the AC contractor shall demonstrate trouble free running of the AC equipments and installation for a period of minimum 120 hours of running as detailed under Para 1.15.

4.2 After the trial run as in Para 1.15 above, the AC contractor shall offer the plant for the seasonal test, namely test for summer or monsoon season whichever occurs earlier. The test results as per Appendix G shall be furnished.

4.3 The equipment capacity computations as per Para '8' under notes of the Annexure 'G' shall be carried out.

4.4 The Input KW of the unit/TR at full load shall also be checked against contract requirements, if any.

4.5 Pressure drops across chiller and condenser at specified flow rates shall be checked against the contract requirements.

- 4.6 All instruments for testing shall be provided by the AC contractor, these shall be as per Note 'A' of Appendix G, The accuracy of the instruments shall be as follows:
- Temperature: Liquid in glass thermometer having accuracy  $\pm 1$  deg. C as per IS: 4825.
  - Wet bulb Temperature: Sling psychomotor conforming to IS:6017,
  - Scale Error: For less than 0 deg.  $-C.0.3^{\circ}C \pm 0.2$  deg. C. For over  $0^{\circ}C$   $0.2^{\circ}C \pm 0.1$  deg.
  - Pressure Gauge: With the accuracy of  $\pm 1\%$  for maximum scale value from 10 to 90%, and  $+1.9\%$  for maximum scale value for rest of the scale conforming to IS: 3695.
  - Water flow meter' Water flow shall be measured using the arrangement installed as per schedule of work,
- 4.7 In case the tendering firms do not have testing instruments of the accuracy mentioned above, they should specify the accuracy of the instrument available with them for testing at the tender stage.

## 5. TESTING REQUIREMENTS AND PROCEDURES

- 5.1 Balancing of all air and water systems and all tests as called for in the specification shall be earned out by the HVAC contractor in accordance with the specifications and relevant local codes if any. Performance tests of individual equipment and control shall be carried out as per manufacturer's recommendation. All tests and balancing shall be carried out in the presence of Engineer-in-charge or his authorized representative. The whole system balancing shall be tested with microprocessor based hi-tech instruments with an accuracy  $\pm 0.5\%$ . The instrument shall be capable of storing data and then down loading into a P.C. The HVAC contractor shall provide a minimum but not limited to the following instruments:
- Microprocessor based calculation meter to measure DB and WB temperature, RH and Dew point
  - Velo meter to measure air volume and air velocity
  - Pitot tube -Electronic rotary vane Anemometer
  - Accubalance flow measuring hood

The contractor shall be responsible to provide necessary sockets and connections for fixing of the testing instruments, probes etc.

## 5.2 REPORTS

Provide 3copies of the complete balancing and testing reports to the department. Report shall be neatly typed and bound suitable for a permanent record. Report

forms shall contain complete test data and equipment data as specified and safety measures provided as per Para 1.14.3.

### 5.3 FINAL DOCUMENTATION

- i) The contractor shall leave the system operating in complete balance with water and air quantities as shown on drawings. Set stops on all balancing valves and lock all damper quadrants in proper position. Secure all automatic damper and valve linkages in proper positions to provide correct operating ranges. Proper damper positions shall be marked on ducts with permanent indication. Notify the department of any areas marginal or unacceptable system performance.
- ii) The above tests and procedures are mentioned herein, for general guidance and information only, but not by way of limitation to the provisions of conditions of contract and design/ performance criteria.
- iii) Upon commissioning and final handover of the installation, the HVAC contractor shall submit (within 4 weeks) to the engineer-in-charge! department 6 (six) portfolios of the following indexed and bound together in hard cover ring binder (300 x 450 mm) in addition to the completion drawings as per Para 1.18.3.
  - a) Comprehensive operation and maintenance manual
  - b) Test certificates, consolidated control diagram and technical literature on all controls.
  - c) Equipment warranties from manufacturers.
  - d) Commissioning and testing reports
  - e) Rating charts for all equipment
  - f) Log books as per equipment manufacturers standard format
  - g) List of recommended spares and consumables
  - h) Any special tools required for the operation or the maintenance of the plant shall be supplied free with the plant.
- iv) At the close of the work and before issue of final certificate of completion by the Engineer-in-charge, the contractor shall furnish a written guarantee indemnifying the department against defective materials and workmanship for the Defects liability period. The contractor shall hold himself fully responsible for reinstallation or replace free of cost to the department.
  - a) Any defective material or equipment supplied by the contractor
  - b) Any material or equipment supplied by the department which is proved to be damaged or destroyed as a result of defective workmanship by the contractor.

## **VII MODE OF MEASUREMENTS**

### **1. UNIT PRICES IN THE SCHEDULE OF QUANTITIES**

1.1 The item description in the schedule of quantities is in the form of a condensed resume. The unit price shall be held to include every thing necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.

1.2 The unit price of the various items shall include the following :

1.2.1 All equipment, machinery, apparatus and materials required as well as the cost of any tests which the consultant may request in addition to the tests generally required to prove quality and performance of equipment.

1.2.2 All the labour required to supply and install the complete installation in accordance with the specifications.

1.2.3 **Use of any tools, equipment, machinery, lifting tackle, scaffolding, ladders etc. Required by the contractor to carry out his work.**

1.2.4 All the necessary measures to prevent the transmission of vibration.

1.2.5 The necessary material to isolate equipment foundations from the building structure, wherever necessary.

1.2.6 Storage and insurance of all equipment apparatus and materials.

1.3 The contractor's unit price shall include all equipment, apparatus, material and labour indicated in the drawings and/or specifications in conjunction with the item in question, as well as all additional equipment, apparatus, material and labour usual and necessary to make in question on its own (and within the system as a whole) complete even though not specifically shown, described or otherwise referred to.

### **2. MEASUREMENTS OF PIPING, FITTINGS, VALVES, FABRICATED ITEMS**

#### **2.1 Pipe :**

(Including water piping, steam piping, oil piping, IP gas piping, air piping, vacuum piping) etc.

- 2.1.1 All pipes shall be measured in linear metre (to the Nearest cm) along the axis of the pipes and rates shall be inclusive of all fittings e.g. Tees, bends, reducers, elbows etc. Deduction shall be made for valves in the line.
- 2.1.2 Exposing reinforcement in wall and ceiling and floor of possible and making good the same or installing anchor fasteners and inclusive of all items as specified in specifications and schedule of quantities.
- 2.1.3 Rates quoted shall be inclusive of providing and fixing Vibration pads and wooden pieces, wherever specified or required by the project co-ordinator.
- 2.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter, with no additional allowance being made for providing the same.
- 2.1.5 The length of the pipe for the purpose of payment will be taken through the centerline of the pipe and all fittings (e.g. Tees, bends, reducers, elbows, etc.) as through the fittings are also presumed to be pipe lengths. Nothing extra whatsoever will be paid for over and above for the fittings for valves and flanges, section 3.2 below applies.

## 2.2 **Valves and Flanges :**

- 2.2.1 All the extra CI & cm flanged valves shall be measured according to the nominal size in mm and shall be measured by number. Such valves shall not be counted as part of pipe length hence deduction in pipe length will be made wherever valves occur.
- 2.2.2 All gun metal (gate & globe) valves shall include two Nos. of flanges and two numbers 150 mm long ms nipples, with one side threaded matching one of the valves, and other welded to the M.S. Slip-on-flange. Rate shall also include the necessary number of bolts, nuts and washers, 3 mm thick insertion gasket of required temp. grade and all items specified in the specifications.
- 2.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks, pumps etc. And the connection made with an installed pipe line shall be included in the rates as per the B.O.Q.

## 2.3 **Structural Supports :**

Structural supports including supports fabricated from pipe lengths for pipes shall be measured as part of pipe line and hence no separate payment will be made. Rates shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as

described in specifications, drawings and schedule of quantities or as required at site by project co-ordinator.

2.4

3. **INSULATION**

3.1 The measurement for vessels, piping, and ducts shall be made over the bare uninsulated surface area of the metal.

3.2 **Pipes, Ducts & Vessels :**

3.2.1 **Pipes :**

The measurements for installation of piping shall be made in linear metres through all valves, flanges, and fittings. Pipes/bends shall be measured along the centerline radius between tangent points. If the outer radius is R1 and the inner radius is R2. The centre line radius shall be measured as  $(R1+R2)/2$ . Measurement of all valves, flanges and fittings shall be measured with the running metre of pipe line as if they are also pipe lengths. Nothing extra over the above shall be payable for insulation over valves, flanges and fittings in pipe line/routings. Fittings that connect two or more different sizes of pipe shall be measured as part of the larger size.

**APPENDIX-B**  
**LIST OF RELEVANT INDIAN STANDARDS**

I.S.3615	Glossary of Terms Used in Refrigeration & Air Conditioning.
I.S.325	Three phase Induction Motors
I.S. 1822	Motor Starters of voltage Not Exceeding 1000 volts
I.S.3624	Bourden Tube Pressure and Vacuum Gauges
I.S.2372	Timber for cooling towers
I.S.7403	Code of practice for selection of standard worm and helical gear boxes
I.S.1620	Horizontal centrifugal pumps for clear, cold, fresh water
I.S.996	Single phase small A.C. and Universal motors
I.S.1239	Mild steel tubes, tubulars and other wrought steel fittings
I.S.3589	Electrically welded steel pipes for water, gas and sewage,
I.S.6392	Steel pipe flanges
I.S.778	Gun metal gate, globe and check valves for general purpose
I.S.2592	Recommendation for methods of measurement of fluid flow by means plates and nozzles
I.S. 277	Galvanised steel sheets
I.S.737	Wrought aluminium and aluminium alloy sheet and strip for general purposes.
I.S.655	Metal air ducts
I.S. 732	Code of practice for electrical wiring and fittings for building.
I.S.2516	A.C. circuit breakers
I.S.900	Code of practice for installation and maintenance of induction motors
I.S. 1248	Direct acting electrical indicating installments
I.S.2516	A.C. circuit breakers for voltages not exceeding 1000 volts
I.S.4047	Heavy duty air break switches and composite units of air break switches for voltage not exceeding 1000 volts.
I.S.2208	HRC cartridge fuse links upto 650 volts
I.S. 1554	PVC insulated (heavy duty) electric cables for working voltage upto and including (PART I) 1100 volts
I.S.8183	Specification for bonded glass wool/ mineral wool
I.S.4671	Specification for expanded polystyrene for thermal insulation purposes.
I.S.11561	Code of practice for testing of cooling towers.
I.S. 7896	Data for outside design conditions for air conditioning for summer months.
I.S.8148	Packages air conditioners
I.S.2370	Sectional cold rooms (walk-in type)
I.S.5111	Testing of refrigerant compressors
I.S.10594	Thermostatic Expansion Valve

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**APPENDIX-C**  
**I.S. SAFETY CODES**

I.S.660	Safety Code for Mechanical Refrigeration
I.S.659	Safety Code for air conditioning
I.S.3016	Code of Practice for precautions in welding and cutting operations
I.S.818	Code of practice for safety and health requirements in electrical and gas welding and cutting operations.
I.S.5216	Code for safety procedure and practice in electrical works
I.S.3696	Safety code for scaffolds and ladders

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**VIII LIST OF APPROVED 'MAKES'**

<b>S.No.</b>	<b>Items</b>	<b>Approved Makes</b>
1	Water chilling unit	Carrier /York/Trane/Bluestar/Voltas/Daikin
2	Control /power cables	Polycab/Havells/Rallison/KEI
3	M.S	Tata/Jindal Hissar/Bhushan/ Jindal Star
4	Flexible pipe connection	Resistoflex/Easyflex
5	Butterfly valve	Advance/Honeywell/L&T
6	Motorized Butterfly Valve	Advance/Honeywell/Siemens
7	Balancing valve	Advance/Honeywell/L&T
8	Non return valve	Advance/Honeywell/L&T
9	Y-Strainer	Emerald/Rapidcool/SM/Sant
10	Pressure gauge	Fiebig/Anergy/Honeywell
11	Thermometer	Fiebig/Anergy/Honeywell
12	Flow Switch	Anergy/Honeywell/Siemens
13	Glass wool	U.P. Twiga/Owen Corning
14	Cable tray	SMC/Airtech/MEM/Rico
15	Scale Preventor	Scale Guard Aqua/ Crystallo/ Supreme of Hitech

**IX SCHEDULE OF EQUIPMENT**

CHILLER PACKAGE -DETAILS TO BE FURNISHED BY TENDERER ALONG WITH OFFER		– DATA SHEET B
S.No	Description	Tenderer To Furnish
1.0	Water Cooled Chilling Unit	
	General Data	
1.1	Number of chillers	
1.2	Location	
1.3	Make and country of origin	
1.4	Model number and year of introduction model from same factory	
1.5	Detailed list of installations of that model in India from same factory	
2.0	Operating Parameters	
2.1	Minimum refrigeration capacity (TR)	
2.2	Minimum chilled water flow rate (USGPM)	
2.3	Maximum chiller pressure drop (Feet of water)	
2.4	Entering chilled water temperature (deg F)	
2.5	Leaving chilled water temperature (deg F)	
2.6	Evaporating temperature (deg F)	
2.7	Fouling factor for chiller	
2.8	KW/TR at full load conditions	
2.9	Entering Condenser water temperature (deg F)	
2.10	Leaving condenser water temperature (deg F)	
2.11	Fouling factor for condenser	
3.0	Compressor	
3.1	Manufacturer	
3.2	Model	
3.3	Type of compressor	
3.4	Speed (operating)	
3.5	Speed (maximum)	
3.6	Refrigerant used	
4.0	Evaporator	
4.1	Manufacturer	
4.2	Model (No)	
4.3	Shell dia. (mm)	
4.4	Tube length (m)	
4.5	No of tubes (No.)	
4.6	Material of tubes (Name)	

	4.7	Dia. of tubes (mm)	
	4.8	No of integral fins / cm (No.)	
	4.9	No of refrigerant circuits (No.)	
	4.10	No of water passes (No.)	
5.0		Compressor Motor	
	5.1	Manufacturer	
	5.2	Type	
	5.3	Motor Voltage	
	5.4	Rated output	
	5.5	Power characteristics	
	5.6	No of Motors	
6.0		Starter for Compressor Motor	
	6.1	Manufacturer	
	6.2	Type of starter	
7.0		Miscellaneous Details	
	7.1	Type of capacity control	
	7.2	Noise level of chiller (in dBA) at 1 m distance	
	7.3	Equipment's size (LXBXH)	
	7.4	Equipment's operating weight (kg) / pounds	
	7.5	Full refrigerant charge quantity	
8.0		Documents to be furnished with bid.	
	8.1	Computerized printout (certified) from chiller manufacturer indicating power consumption in IKW/TR at full load and various part load conditions as per AHRI format	
	8.2	Catalogues furnishing detailed technical data for compressor, evaporator, condenser, microprocessor or micro-computer control panel etc.	

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**X      TEST PROFORMA**

<u>S.No.</u>	<u>Item</u>	<u>Unit</u>	<u>Test Result</u>
1.	<b><u>Operating Conditions</u></b>		
1.1	Ambient conditions		
	-Temp. D.B.	O C	
1.2	-Temp. W.B.	O C	
1.3	-R.H.	%	
2.	<b><u>Water Chilling Units</u></b>		<b><u>Screw</u></b>
2.1	<b><u>Chiller</u></b>		
2.1.1	Water flow rate	lpm	
2.1.2	Water temp. -Entering	O C	
2.1.3	Water temp. -Leaving	O C	
2.1.4	Water pressure -Entering	mmHg.	
2.1.5	Water pressure - Leaving	mmHg.	
2.2	<b><u>Compressor</u></b>		
2.2.1	Speed	rpm	
2.2.2	Refrigerant Temp.	O C	
2.2.3	Refrigerant suction pressure	mmHg.	
2.2.4	Discharge pressure	mmHg.	
2.2.5	Oil pressure	mmHg.	
2.2.6	Computed capacity at 100% Load on compressor	kcal/hr	
2.2.7	Compressor Motor		
2.2.7.1	Speed	rpm	

2.2.7.2 Voltage Volts

2.2.7.3 Current at 100% load Amp

<u>S.No.</u>	<u>Item</u>	<u>Unit</u>	<u>Test Result</u>
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2.3 **Condenser**

2.3.1 Water flow rate lpm

2.3.2 Water temp. -Entering °C

2.3.3 Water temp. -Leaving °C

2.3.4 Water pressure -Entering mmHg.

2.3.5 Water pressure -Leaving mmHg.

2.3.6 Refrigerant condensing pressure mmHg.

2.3.7 Refrigerant condensing temperature °C

2.3.8 Specified capacity kcal/hr.

2.3.9 Stipulated capacity at 100%  
load on the compressor kcal/hr.

2.3 Power Consumption at Various Load

100% kw

90% kw

80% kw

75% kw

70% kw

60% kw

50% kw

40% kw

30% kw

25% kw

3. **Pumps** Condenser Chilled  
 water Primary

Secondary

- 3.1 Impeller dia mm
- 3.2 Speed rpm
- 3.3 Water pressure -Entering mmHg.

<b><u>S.No.</u></b>	<b><u>Item</u></b>	<b><u>Unit</u></b>	<b><u>Test Result</u></b>
3.4	Water pressure -Leaving	mmHg.	
3.5	Water flow rate specified	LPM	
3.6	Water flow rate computed	LPM	
3.7	Motor rating	kw	
3.8	Motor current at full load	Amps	
3.9	Fan motor voltage	Volts	
3.10	Fan motor speed	RPM	
3.11	Specified capacity	kcal/hr.	
3.12	Computed capacity	kcal/hr.	

\*\*\*\*\*

**NON-BLACK LISTING DECLARATION**

**FORMAT OF UNDERTAKING, TO BE FURNISHED ON COMPANY LETTER HEAD  
WITH REGARD TO BLACKLISTING/ NON- DEBARMENT, BY ORGANISATION**

UNDERTAKING REGARDING BLACKLISTING / NON – DEBARMENT

To, Registrar  
IIITD Campus  
Okhla Phase-III,  
New Delhi-110020

We hereby confirm and declare that we, M/s -----, is not blacklisted/ De-registered/ debarred by any Government department/ Public Sector Undertaking/ Private Sector/ or any other agency for which we have Executed/ Undertaken the works/ Services during the last 5 years.

**Signature of Contractor**

**With stamp**

**Annexure - XX**

***GENERAL INSTRUCTIONS FOR SITE VISIT***

I, , aged        years, son/daughter of       , presently residing at        and        authorized        by        (name of tenderer) (“Tenderer”) to solemn this affidavit on behalf of the Tenderer, solemnly affirm on oath as hereunder:

The Tenderer confirms that the Tenderer has duly undertaken the visit of the proposed project site of IIITD located at Okhla Phase III, New Delhi,

The Tenderer has inspected and examined its surroundings and has satisfied itself about the site conditions and site logistics. The Tenderer confirms that it is aware of the ground conditions and nature of the site, means of access to the site and the accommodation area required for establishing the labour camp. The Tenderer agrees and confirms it shall be solely responsible for arranging and maintaining the aforementioned at its own cost including all materials, tools & plants, water, electricity, access, facilities for workers and all other services required for executing the Work unless otherwise specifically provided for in the contract documents.

The Tenderer confirms and agrees that the submission of the tender implies that the requisite site visit has already been undertaken and that the Tenderer has acquainted itself with the local conditions and other factors having a bearing on the execution of the Work.

**DEPONENT VERIFICATION**

I, , aged        years, son/daughter of       , presently residing at        and        authorized        by        Tenderer verify that the information mentioned above is true and correct to the best of my knowledge and belief.

**DEPONENT**



**AGREEMENT**

AN AGREEMENT is made this -----BETWEEN the Indraprastha Institute of Information Technology. A State University established by Govt Of NCT of Delhi ,and with its registered office at IIITD Campus , Okhla Phase III , New Delhi 110020, which expression shall include its successor, unless repugnant to or Excluded by the contract here of and assignees of and represented by its Registrar, IIITD the first party (hereinafter called the Authority) and by its sole proprietor/partners/Director.of M/s -----and having registered office at ----- (which expression shall be including his / its successor's heirs, executors, representative and or assignees of the second party (hereinafter called the contractor}).

WHEREAS the Authority has, under tender Notification No. -----

WHEREAS the contractor has submitted tender for carrying out the work as above as per the tender document page ---- to ----- and has represented that in conformity with his / its obligation contained in the tender as modified by the correction slips and corrigendum contained he / it shall carryout the same truly, faithfully and honestly.

THE SAME has been accepted by both the parties on the terms and conditions, corrections, corrigendum contained in the tender as modified as well as the letter of acceptance Issued party No.1 annexed here to as.

The same shall be binding on both the parties.

IN WITNESS WHEREOF, the parties have signed the deed of agreement on the date, month and year referred to above.

Date: At New Delhi.

Signed by

Party No.1 Party No.2

WITNESS

1. Party No.1
2. Party No.2

## DRAWINGS

**BOQ FOR SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 1 x 240 TR & 1 X 165 TR WATER COOLED SCREW CHILLERS AND ALLIED WORKS**

S. NO.	DESCRIPTION OF ITEMS	Unit	Qty.	Rate	Amount
				Rs.	Rs.
1.	<b><u>Water Chilling Unit</u></b>				
1.1	Supply, Installation, Testing and Commissioning of AHRI Certified Water Cooled Screw type water chilling machine each having a minimum capacity of 240 TR (actual) at chilled water inlet/outlet temperature of 6.7°C/12.2°C with chilled water circulation rate of 576 USGPM and condenser water inlet/outlet temperature of 32.2°C/36.4°C with circulation rate of 960 USGPM, suitable for operation on refrigerant R-134a for screw type machine each comprising of the following complete as per specifications and as required. Quoted price shall include price of Variable Frequency Drive starter of suitable capacity. All associated cutting, welding, pipe works, dismantling, making good of the civil works including dismantling /cutting open/repair /painting complete as required shall be undertaken by the Contractor. No extra shall be payable for the same. Site must be inspected prior to quoting for suitability, installation and commissioning. No extra shall be payable for any issues for want of site knowledge.				
a)	Twin rotary inverter based compressor semi-hermetic complete with automatic capacity control safety switches, forced feed lubrication system etc. as per specifications.				
b)	Suitable capacity squirrel cage induction motor with class 'B' insulation suitable for operation on 415 +- 10% volts, 50Hz, A.C. supply.				
c)	VFD Starter of suitable capacity				
d)	Necessary drive arrangement.				
e)	1 set - Lubrication device consisting of automatic electric oil pump, oil cooler, head tank, oil strainer, and automatic pressure regulating valve, oil heater, oil heater thermal switch etc. as per specifications.				

f)	1 no. - Matching shell and tube even pass water cooled condenser of M.S. shell and integrally finned copper tubes with Mandatory ASME (U)/GB Stamping.				
g)	1 no. - matching shell & tube even pass flooded type chiller for screw type units of MS shell and copper tubes with Mandatory ASME (U)/GB Stamping.				
h)	1 Lot- Refrigerant piping fittings, valves and accessories to inter connect compressor, condenser, chiller and expansion valve.				
i)	1 set- Microprocessor based control panel complete with accessories as per specifications.				
j)	Lot- Refrigerant line accessories comprising of safety valves, angle valve, liquid line indications, liquid level control etc.				
k)	Lot - Water flow switches at outlet of condenser & chiller, water drain, air purge valves, thermometers and pressure gauges wherever required.				
l	Lot - Suction line and chiller insulation with minimum 19 mm thick polyvinyl nitrile rubber insulation complete as required.				
m)	Lot- Frame work for mounting the above condenser, chiller compressor and motor with base plate complete with anti-vibration pads/springs.				
n)	Lot- Initial/first charge of refrigerant gas & compressor oil.				
o)	Third party BMS integration card on Modbus/Bacnet protocol				
	Chilling machine described above, as per specifications and complete in all respects for the operating parameters as given under.				
	<b>Chiller</b>				
	Chiller Water IN            12.2 °C				
	Chilled Water OUT        6.7 °C				
	Chilled water Flow        576 USGPM				

	Max Pressure Drop: 5 m				
	Fouling Factor 0.0005 FPS				
	<b>Condenser</b>				
	Condenser Water IN 32.2°F				
	Condenser Water Flow 960 USGPM				
	Fouling Factor 0.001 FPS				
	Max Pressure Drop: 12 m				
	Minimum COP as per ECBC Guidelines = 5.4				
	<b>Load</b>				
	IKW/TR at 100% Load at Design Conditions = 0.76				
	NPLV at Design Conditions = 0.39 IKW/TR				
	Chilling machines as described above	Nos.	1		
2.	<b><u>Water Chilling Unit</u></b>				
2.1	Supply, Installation, Testing and Commissioning of Water Cooled Screw type water chilling machine each having a minimum capacity of 165 TR (actual) at chilled water inlet/outlet temperature of 6.7°C/12.2°C with chilled water circulation rate of 396 USGPM and condenser water inlet/outlet temperature of 37.78°C/36.4°C with circulation rate of 486 USGPM, suitable for operation on refrigerant R-134a for screw type machine each comprising of the following complete as per specifications and as required. Quoted price shall include price of Variable Frequency Drive starter of suitable capacity. All associated cutting, welding, pipe works, dismantling, making good of the civil works including dismantling /cutting open/repair /painting complete as required shall be undertaken by the Contractor. No extra shall be payable for the same. Site must be inspected prior to quoting for suitability, installation and commissioning. No extra shall be payable for the same.				
a)	Twin rotary inverter based compressor semi-hermetic complete with automatic capacity control safety switches, forced feed lubrication system etc. as per specifications.				
b)	Suitable capacity squirrel cage induction motor with class 'B' insulation suitable for operation on 415 +/- 10% volts, 50Hz, A.C. supply.				
c)	VFD Starter of suitable capacity				
d)	Necessary drive arrangement.				

e)	1 set - Lubrication device consisting of automatic electric oil pump, oil cooler, head tank, oil strainer, and automatic pressure regulating valve, oil heater, oil heater thermal switch etc. as per specifications.				
f)	1 no. - Matching shell and tube even pass water cooled condenser of M.S. shell and integrally finned copper tubes with Mandatory ASME (U)/GB Stamping.				
g)	1 no. - matching shell & tube even pass flooded type chiller for screw type units of MS shell and copper tubes with Mandatory ASME (U)/GB Stamping.				
h)	1 Lot- Refrigerant piping fittings, valves and accessories to inter connect compressor, condenser, chiller and expansion valve.				
i)	1 set- Microprocessor based control panel complete with accessories as per specifications.				
j)	Lot- Refrigerant line accessories comprising of safety valves, angle valve, liquid line indications, liquid level control etc.				
k)	Lot - Water flow switches at outlet of condenser & chiller, water drain, air purge valves, thermometers and pressure gauges wherever required.				
l)	Lot - Suction line and chiller insulation with minimum 19 mm thick polyvinyl nitrile rubber insulation complete as required.				
m)	Lot- Frame work for mounting the above condenser, chiller compressor and motor with base plate complete with anti-vibration pads/springs.				
n)	Lot- Initial/first charge of refrigerant gas & compressor oil.				
o)	Third party BMS integration card on Modbus/Bacnet protocol				

	Chilling machine described above, as per specifications and complete in all respects for the operating parameters as given under.				
	<b>Chiller</b>				
	Chiller Water IN 12.2 °C				
	Chilled Water OUT 6.7 °C				
	Chilled water Flow 396 USGPM				
	Max Pressure Drop: 5 m				
	Fouling Factor 0.0005 FPS				
	<b>Condenser</b>				
	Condenser Water IN 32.2°F				
	Condenser Water OUT 37.78°F				
	Condenser Water Flow 486 USGPM				
	Max Pressure Drop: 7 m				
	Fouling Factor 0.001 FPS				
	Minimum COP as per ECBC Guidelines = 5.4 at 100%				
	<b>Load</b>				
	IKW/TR at 100% Load at Design Conditions = 0.79				
	NPLV at Design Conditions = 0.40 IKW/TR				
	Chilling machines as described above	Nos.	1		
<b>3.</b>	<b><u>Pump Set</u></b>				
	Installation, testing and commissioning of existing end suction back pull out water circulation pump in cast iron body & Bronze impeller, Pump are available on site in AC plant room, Vendor scope to check the same before quote and shall complete the work for proper working of pumps etc. Nothing will be paid extra. (quote includes as per requirements and proper working of the same)(Pump Shall be placed on existing foundation on site) <b>Note-Vendor must visit site for clarity.</b>				
3.1	<b><u>For Chiller ( with insulation of pump)</u></b>				
	Capacity : 396 USGPM,40 Feet Head.	Nos.	1		
3.2	<b><u>For Condenser</u></b>				
	Capacity : 486 USGPM,40 Feet Head	Nos.	1		
<b>4.</b>	<b>Non Chemical Water Treatment System.</b>				

	Supply, Installation, Testing and Commissioning of On-line, Non-Chemical Water Treatment Scale Preventor System with all required accessories, selection shall be based on flow rates/TR of chillers as specified in chiller item head, Scale preventor shall prevent the formation of hard scales in cooling circuits of AC system, This online type preventor shall work with combination of adsorption, turbulence and galvanic action as per detailed specification and requirements, cutting existing line and fit the system including everything nothing shall be payable extra on this account and shall be as per specification and requirement and as per instruction of Engineer In Charge/Consultants.(3X240TR + 3X165TR CHILLERS)	Nos.	6		
<b>5.</b>	<b><u>Insulated Chilled Water Piping (Resin Bonded fiberglass glass Insulation)</u></b>				
	Supplying, laying/ fixing, testing and commissioning of following nominal sizes of chilled water piping inside the building (with necessary clamps, vibration isolators and fittings but excluding valves, strainers, gauges etc.) duly insulated with 80 kg/cum density resin bonded fiber glass or 144kg/cum density mineral wool(non combustible) pipe sections insulation covered with a layer of 120 gm/sqm polythene sheet (vapour barrier) and finally applying 0.63mm aluminium sheet cladding complete with type 3, grade 1 roofing felt strip (as per IS:1322 as amended upto date) at joints and repairing of damage to building etc. as per specifications and as required. Note: The Pipes of sizes 150mm & below shall be M.S. 'C' class as per IS : 1239 and pipes size above 150mm shall be welded black steel pipe heavy class as per IS: 3589, from minimum 6.35mm thick M.S. Sheet for pipes upto 350 mm dia. and from minimum 7mm thick MS sheet for pipes of 400 mm dia and above.				
<b>5.1</b>	<b><u>Piping</u></b>				
<b>5.1.1</b>	300 mm dia (75mm thick insulation)	Rm	RO		
<b>5.1.2</b>	250 mm dia (75mm thick insulation)	Rm	30		
<b>5.1.3</b>	125 mm dia (50mm thick insulation)	Rm	30		
<b>5.1.4</b>	100 mm dia (50mm thick insulation)	Rm	RO		



5.1.5	80 mm dia (50mm thick insulation)	Rm	RO		
<b>5.2</b>	<b><u>Insulated Valves</u></b>				
	Supplying, fixing, testing and commissioning of following valves, strainers, gauges in the chilled water plumbing duly insulated to the same specifications as the connected piping and adequately supported as per specifications.				
5.2.1	Supply, installation, testing and commissioning of <b>Motorized Butterfly Valves</b> along with Controls Actuators, with remote open/close command and open/close potential free contacts and Control Wiring, Transformer etc.				
5.2.1.1	250 mm dia	Nos.	1		
5.2.1.2	125 mm dia	Nos.	1		
5.2.2	<b>Butterfly Valve (Manual)</b> with C I body SS Disc, Nitrile Rubber Seal & O- Ring PN 16 pressure rating for chilled water/hot water circulation as specified.				
5.2.2.1	250 mm	Nos.	1		
5.2.2.2	125 mm	Nos.	3		
5.2.3	<b>Balancing Valve with Built in Measuring Facility</b> with C I body flanged construction with EPDM coated disc with long pitch with protected out pipe insulation & PN 16 pressure rating for chilled / hot water circulation as specified.				
5.2.3.1	250 mm	No.	1		
5.2.3.2	125 mm	Nos.	1		
5.2.4	<b><u>Non Return Valves</u></b>				
	Non return valve with dual plate of CI body and SS plates vulcanized NBR seal flanged and PN 16 pressure rating for chilled / hot water circulation including insulation as specified.				

5.2.4.1	125 mm	Nos.	1		
5.2.5	<b>Y - Strainer</b> of Ductile CI Body flanged ends with stainless steel strainer for chilled / hot water circulation including insulation as specified.				
5.2.5.1	125 mm	Nos.	1		
<b>5.3</b>	Providing and fixing in position the industrial type <b>pressure gauges</b> with gun metal / brass valves complete as required.	Nos.	6		
<b>5.4</b>	Providing & fixing in position the mercury in glass industrial type <b>thermometers</b> .	Nos.	4		
<b>5.5</b>	Providing & fixing in position Water flow switch as per requirement and standards.	Nos.	2		
<b>5.6</b>	<b><u>Flexible Connections</u></b>				
	-				
	SITC of flexible pipe connection with all required accessories like flanges, nut bolts etc for chilled water/hot water circulation as specified.				
5.6.1	250 mm	Nos.	2		
	-				
5.6.2	125 mm	Nos.	4		
	-				
<b>6.</b>	<b><u>Condenser Water Piping</u></b>				
	Supplying, fixing, testing and commissioning of condenser water pipes of following sizes of MS 'C' class along with necessary clamps, vibration isolators and fittings such as bends, tees etc. But excluding valves, strainers, gauges etc. adequately supported on rigid supports duly painted/buried in ground excavation and refilling etc. as per specification and as required complete in all respect.				
	Note:-The Pipes size 150mm & below shall be M.S. 'C' class as per IS : 1239 and pipes size above 150mm shall be welded black steel pipe heavy class as per IS: 3589, from minimum 6.35mm thick M.S. Sheet for pipes upto 350 mm dia. And from minimum 7mm thick MS sheet for pipes of 400 mm dia and above.				

<b>6.1</b>	<b><u>Piping</u></b>				
6.1.1	250 mm dia	Rm	30		
6.1.2	150 mm dia	Rm	30		
<b>6.2</b>	<b><u>Valves without Insulation</u></b>				
	Supplying, fixing, testing and commissioning of following valves, gauges and strainers for condenser water circulation as per specifications.				
6.2.2	Supply, installation, testing and commissioning of <b>Motorized Butterfly Valves</b> along with Controls Actuators, with remote open/close command and open/close potential free contacts and Control Wiring, Transformer etc.				
6.2.2.1	250 mm	Nos.	1		
6.2.2.2	150 mm	Nos.	1		
6.2.3	<b>BUTTERFLY VALVE (MANUAL)</b> with C I body SS disc nitrile sheet & O - ring & PN 16 pressure rating as specified.				
6.2.3.1	250 mm	Nos.	1		
6.2.3.2	150 mm	Nos.	3		
6.2.4	<b>NON - RETURN VALVE</b> with dual plate of C I body SS plates vulcanized NBR seal flanged end & PN 16 pressure rating as specified.				
6.2.4.1	150 mm	Nos.	1		
6.2.5	<b>Y - Strainer</b> of Ductile CI Body flanged ends with stainless steel strainer for chilled / hot water circulation including insulation as specified.				
6.2.5.1	150 mm	Nos.	1		

6.2.6	<b>Balancing Valve with Built in Measuring Facility</b> with C I body flanged construction with EPDM coated disc with longpitch with protected out pipe insulation & PN 16 pressure ratingfor chilled / hot water circulation as specified.				
6.2.6.1	250 mm	Nos.	1		
6.2.6.2	150 mm	Nos.	1		
<b>6.3</b>	Providing and fixing of in position the industrial type <b>pressure gauges</b> with gun metal / brass valves complete as required.	Nos.	6		
<b>6.4</b>	Providing & fixing of in position the mercury in glass industrial type <b>thermometers</b> .	Nos.	4		
<b>6.5</b>	Providing & fixing in position Water flow switch as per requirement and standards.	Nos.	2		
<b>6.6</b>	<b><u>Flexible Connections</u></b>				
	-				
	SITC of flexible pipe connection with all required accessories like flanges,nut bolts etc for chilled water/hot water circulation as specified.				
6.6.1	250 mm	Nos.	2		
6.6.2	150 mm	Nos.	4		
<b>7.</b>	<b><u>Power Cabling</u></b>				
	Supply and installation of XLPE FRLS, cores laid up, tape inner sheathed, armoured aluminium cables for various equipments along with cable terminations lugs, glands, tagging etc. through walls/ceiling with appropriate clamps & fixing arrangement for running on cable tray, as per specifications and drawings.				
7.1	3.5C x 400 sqmm -240TR Chiller	RMT	60		
7.2	3.5C x 300 sqmm -165TR Chiller	RMT	80		
7.3	3 C - 10 sqmm	RMT	100		

7.4	3 C - 6 sqmm	RMT	50		
<b>8.</b>	<b>CABLE TRAY</b>				
	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray (Galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required.				
8.1	300mm width x 62.5mm depth x 2.0mm thickness	RMT	50		
8.2	150mm width x 50mm depth x 1.6mm thickness	RMT	60		
<b>9.</b>	<b><u>Earthing</u></b>				
9.1	Providing & fixing 25 mm x 6 mm G.I. strip on surface or in recess for connections etc. as required.	RMT	200		
9.2	Providing & fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	RMT	300		
	<b>Total Amount</b>				
	GST @ 18%				
	Total Amount with GST				

Note: All rate to be inclusive cost of Transportation, Labour, Materials, lifting , loading, unloading , crane etc. as required for satisfactory completion of work.

In words (Rs) ( \_\_\_\_\_ )

**Bill of Quantity (Optional Items)**

<b>S.No.</b>	<b>Comprehensive Annual Maintenance Contract of</b>	<b>Amount</b>
1	Comprehensive Annual Maintenance Contract after the completion of Defects Liability Period, inclusive of Labour, Materials, Transportation, Tool & Plants, Spares, Consumables, Components etc. For all kinds of Preventive & Breakdown Maintenance. Breakdown Maintenance will be required to be carried out based on the arising on 24 hrs x 365 days basis.	
1	<b>I Year</b>	
2	<b>II Year</b>	
3	<b>III Year</b>	
4	<b>IV Year</b>	
5	<b>V Year</b>	
	<b>TOTAL AMOUNT</b>	
	<b>GST</b>	
	<b>TOTAL AMOUNT WITH GST</b>	

**Note:-**

1. Above Prices will not be part of Tender Evaluation
2. It will not be binding on IIITD for entering into above Comprehensive Annual Maintenance Contract
3. If IIITD decides to enter into the above Comprehensive Annual Maintenance Contract, a separate Contract Agreement shall be made, which will not be part of this Contract
4. Tenderers are expected to quote Reasonable Prices.

- GENERAL NOTES :-**
1. ALL DIMENSIONS ARE IN MM
  2. ALL FOUNDATION WORK IS IN CLIENT SCOPE
  3. ALL DIMENSIONS MENTIONED IN ARCHITECT'S INTERIORS DESIGNERS DRAWINGS SUCH AS BOTTOM OF BEAM TOP OF BEAM LOCATIONS FROM A HEIGHT OF FALSE CEILING FINISH FLOOR MUST BE CHECKED AT SITE AND IF FOUND ANY DISCREPANCY MUST BE REPORTED TO THE CONCERN PARTY
  4. ALL PIPE SIZES REFERS TO SCHEMATIC DWG.

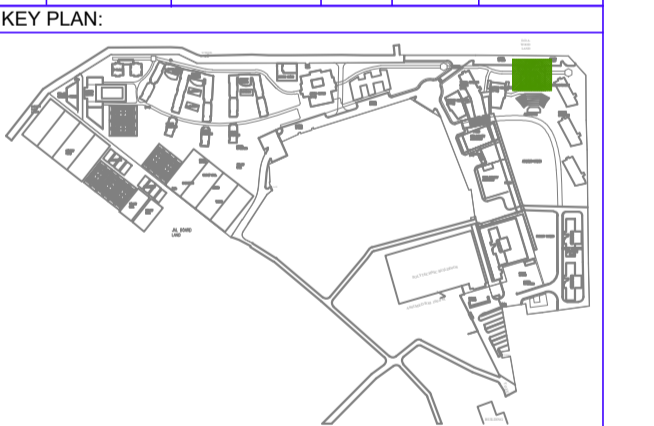
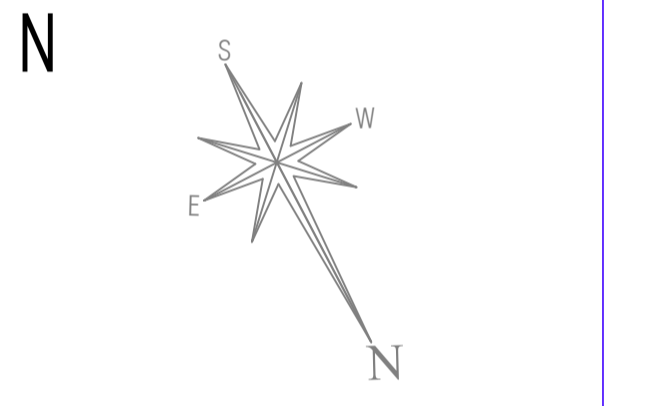
**LEGENDS**

SYMBOL	ITEM	SYMBOL	ITEM
	BUTTERFLY VALVE		MOTORISED BUTTERFLY VALVE
	BALANCING VALVE		NON RETURN VALVE
	PRESSURE GAUGE		Y-STRAINER
	WATER FLOW SWITCH		TEMPERATURE GAUGE
CS	CEILING SUPPORT	SO	SUMMER OPEN/WINTER CLOSE
PS	PIPE SUPPORT	SC	SUMMER CLOSE/WINTER OPEN
	CDW SUPPLY PIPE		CDW SUPPLY PIPE
	CDW RETURN PIPE		CDW RETURN PIPE
	CDW EQUALIZER PIPE		CDW MAKE UP PIPE
	CDW DRAIN PIPE		HOT WATER SUPPLY
	HOT WATER RETURN		

TENDER DRAWING

**REFERENCE DRAWINGS:**

IT.	DRAWING TITLE	DRAWING No.	DATE	REV.
1				
2				
3				
4				
5				



**PROJECT TITLE:**  
Proposed campus for Indraprastha Institute of Information Technology (IIIT) at Okhla Industrial Estate Ph. III, NEW DELHI - 110020

**HVAC CONSULTANTS**  
**SSA CONSULTANTS**  
FLAT NO-403, P-88 & 89, NAFEES ROAD JAMIA NAGAR, OKHLA, NEW DELHI-110025  
E-MAIL: ssaconsultants18@gmail.com

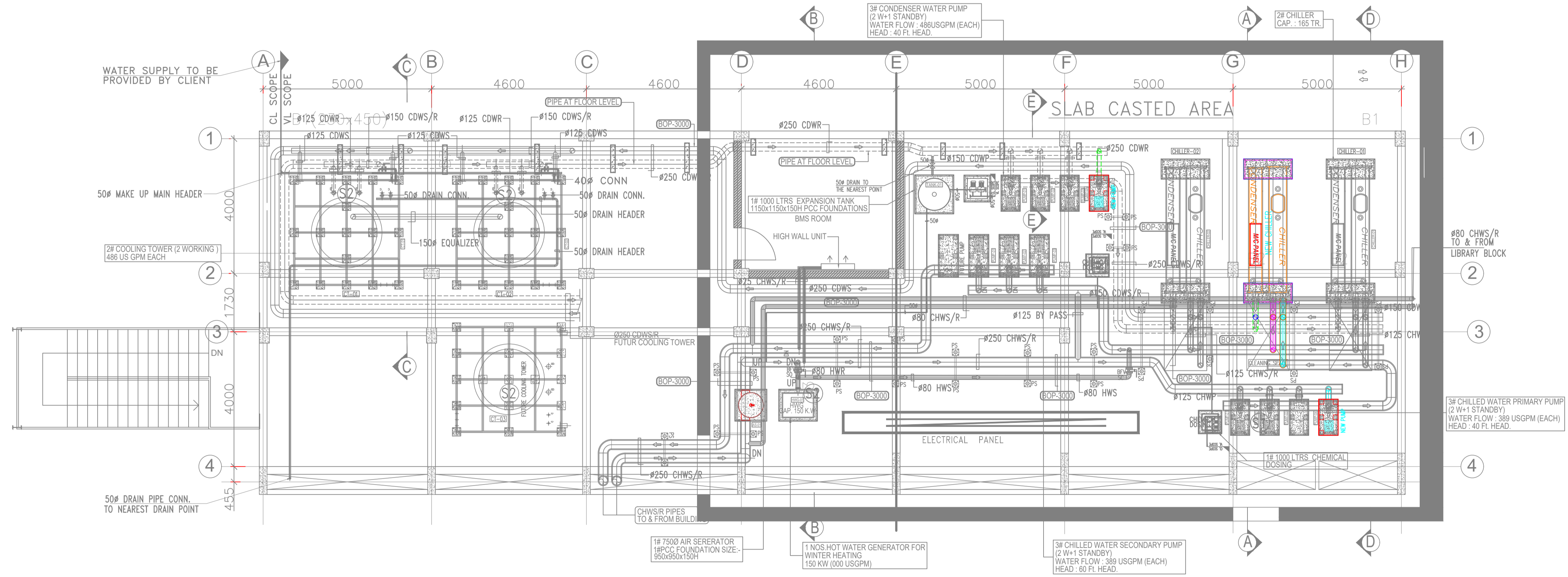
**STATUS: TENDER DRAWING**

**DRAWING TITLE:**  
HVAC PLANT ROOM LAYOUT FOR SERVICE BUILDING. ( IIIT )

DRAWN BY	CHECKED BY	DATE	SCALE
WS	SS	26.05.2023	1:50

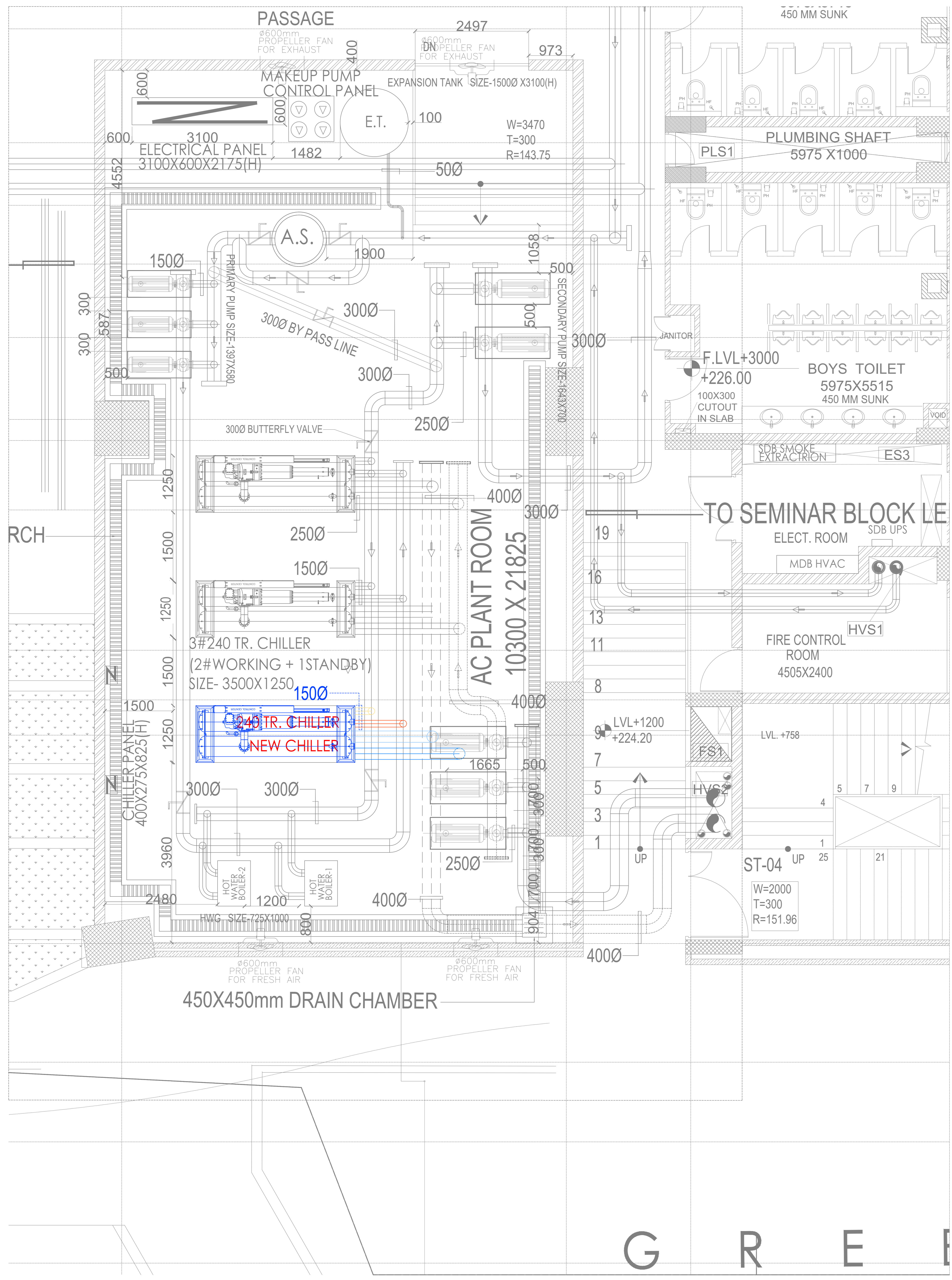
DRAWING No.	SHEET NO.	REVISION
AC-01	01	00

**APPROVED BY:**  
CLIENT:



**FRAMING PLAN AT TERRACE FLOOR LVL.**  
ALL BEAM SIZE(230X450)U.N.O.





**GENERAL NOTES :-**  
 1. ALL DIMENSIONS ARE IN MM.  
 2. ALL FOUNDATION WORK IS IN CLIENT SCOPE.  
 3. ALL DIMENSIONS MENTIONED IN ARCHITECTS/INTERIORS DESIGNERS DRAWINGS SUCH AS BOTTOM OF BEAM, DEPTH OF BEAM, LOCATION OF BEAM, HEIGHT OF FALSE CEILING, SINKING ETC. MUST BE CHECKED AT SITE AND IF FOUND ANY DISCREPANCY MUST BE REPORTED TO THE CONSULTANT IMMEDIATELY.  
 4. ALL PIPE SIZES REFERS TO SCHEMATIC DWG.

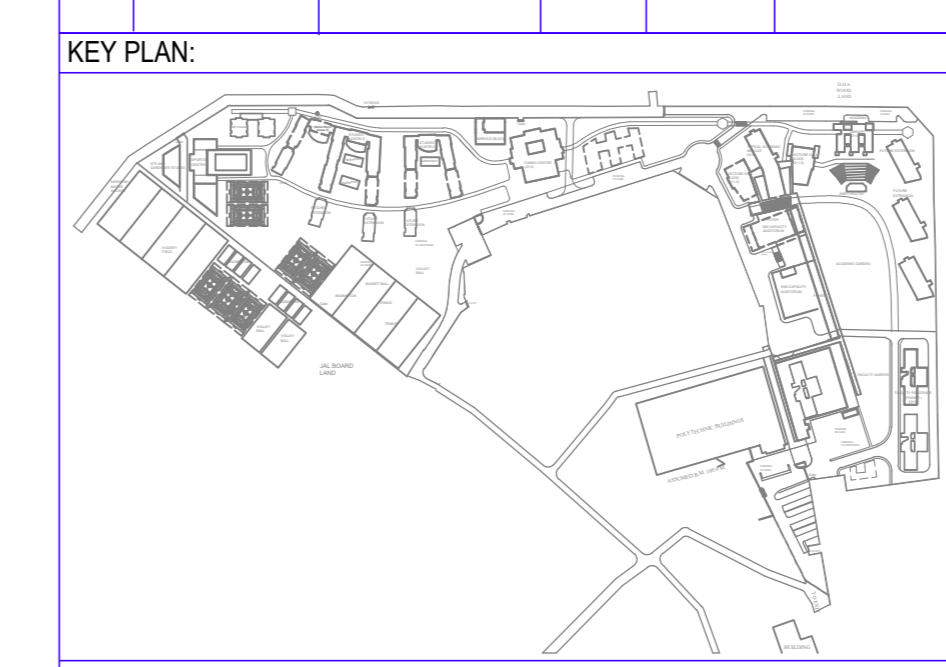
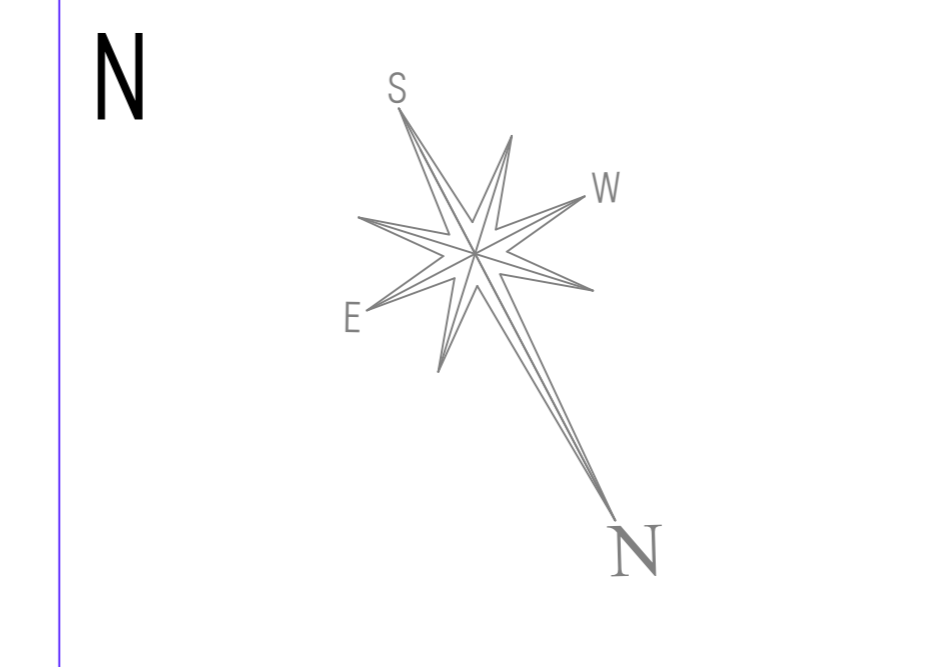
**LEGENDS**

SYMBOL	ITEM	SYMBOL	ITEM
	BUTTERFLY VALVE		MOTORISED BUTTERFLY VALVE
	BALANCING VALVE		NON RETURN VALVE
	PRESSURE GAUGE		Y-STRAINER
	WATER FLOW SWITCH		TEMPERATURE GAUGE
	CEILING SUPPORT		SUMMER OPEN/WINTER CLOSE
	PIPE SUPPORT		SUMMER CLOSE/WINTER OPEN
	CDW SUPPLY PIPE		CHW SUPPLY PIPE
	CDW RETURN PIPE		CHW RETURN PIPE
	CDW EQUALIZER PIPE		CDW MAKE UP PIPE
	CDW DRAIN PIPE		HOT WATER SUPPLY
	HOT WATER RETURN		

**TENDER DRAWING**

**REFERENCE DRAWINGS.**

IT.	DRAWING TITLE	DRAWING No.	DATE	REV.
1.				
2.				
3.				
4.				
5.				



**PROJECT TITLE:**  
 Proposed campus for Indraprastha Institute of Information Technology (IIIT) at Okhla Industrial Estate, Ph. III, NEW DELHI - 110020

**HVAC CONSULTANTS**  
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**STATUS: TENDER DRAWING**

**DRAWING TITLE:**  
 HVAC PLANT ROOM LAYOUT FOR SERVICE BUILDING. ( IIIT )

DRAWN BY	CHECKED BY	DATE	SCALE
WS	SS	26.06.2023	1:50

DRAWING No.	SHEET NO.	REVISION
AC-01	01	00

**APPROVED BY:**  
 CLIENT: