STATE OF NORTH CAROLINA

Issued by: The University of North Carolina at Chapel Hill

Invitation for Bid #: 3000012132

Description: Pre-purchased Cooling Towers, East Chiller Plant

Date Issued: 02-13-2025

Bid Opening Date: 03-07-2025 NLT 1:00 PM EST

Direct all inquiries concerning this IFB to:

Mark Thomas Sillman

Associate Director Purchasing Services

Email: mark_sillman@unc.edu

STATE OF NORTH CAROLINA

Invitation for Bids

3000012132

For internal State agency processing, including tabulation of bids, provide your company's eVP (Electronic Vendor Portal) Number. Pursuant to G.S. 132-1.10(b) this identification number shall not be released to the public. **This page will be removed and shredded, or otherwise kept confidential**, before the procurement file is made available for public inspection.

This page shall be filled out and returned with your bid.
Failure to do so shall be sufficient cause to reject your bid.

_____

Vendor Name

_____

Vendor eVP #

Note: For a contract to be awarded to you, your company (you) must be a North Carolina registered vendor in good standing. You must enter the vendor number assigned through eVP (Electronic Vendor Portal). If you do not have a vendor number, register at https://vendor.ncgov.com/vendor/login

STATE OF NORTH CAROLINA
The University of North Carolina at Chapel Hill

Refer *ALL* Inquiries regarding this IFB to: ***SEE FRONT COVER***	**Invitation for Bids # 3000012132** **Bids will be publicly opened: 03-07-2025**
Using Agency: UNC-CH **Requisition No.: 1001013588**	**Commodity No. and Description:**

EXECUTION

In compliance with this Invitation for Bids (IFB), and subject to all the conditions herein, the undersigned Vendor offers and agrees to furnish and deliver any or all items upon which prices are bid, at the prices set opposite each item within the time specified herein.

By executing this bid, the undersigned Vendor understands that false certification is a Class I felony and certifies that:

- this bid is submitted competitively and without collusion (G.S. 143-54),
- that none of its officers, directors, or owners of an unincorporated business entity has been convicted of any violations of Chapter 78A of the General Statutes, the Securities Act of 1933, or the Securities Exchange Act of 1934 (G.S. 143-59.2), and
- it is not an ineligible Vendor as set forth in G.S. 143-59.1.

Furthermore, by executing this bid, the undersigned certifies to the best of Vendor's knowledge and belief, that:

- it and its principals are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from covered transactions by any Federal or State department or agency.

As required by G.S. 143-48.5, the undersigned Vendor certifies that it, and each of its sub-Contractors for any Contract awarded as a result of this IFB, complies with the requirements of Article 2 of Chapter 64 of the NC General Statutes, including the requirement for each employer with more than 25 employees in North Carolina to verify the work authorization of its employees through the federal E-Verify system.

As required by Executive Order 24 (2017), the undersigned vendor certifies will comply with all Federal and State requirements concerning fair employment and that it does not and will not discriminate, harass, or retaliate against any employee in connection with performance of any Contract arising from this solicitation.

G.S. 133-32 and Executive Order 24 (2009) prohibit the offer to, or acceptance by, any State Employee associated with the preparing plans, specifications, estimates for public Contract; or awarding or administering public Contracts; or inspecting or supervising delivery of the public Contract of any gift from anyone with a Contract with the State, or from any person seeking to do business with the State. By execution of this bid response to the IFB, the undersigned certifies, for Vendor's entire organization and its employees or agents, that Vendor are not aware that any such gift has been offered, accepted, or promised by any employees or agents of Vendor's organization.

By executing this bid, Vendor certifies that it has read and agreed to the **INSTRUCTION TO VENDORS** and the **NORTH CAROLINA GENERAL TERMS AND CONDITIONS incorporated herein**. These documents can be accessed from the ATTACHMENTS page within this document.

Failure to execute/sign bid prior to submittal may render bid invalid and it MAY BE REJECTED. Late bids cannot be accepted.

COMPLETE/FORMAL NAME OF VENDOR:			
STREET ADDRESS:		P.O. BOX:	ZIP:
CITY & STATE & ZIP:		TELEPHONE NUMBER:	TOLL FREE TEL. NO:
PRINCIPAL PLACE OF BUSINESS ADDRESS IF DIFFERENT FROM ABOVE (SEE INSTRUCTIONS TO VENDORS ITEM #21):			
PRINT NAME & TITLE OF PERSON SIGNING ON BEHALF OF VENDOR:		FAX NUMBER:	
VENDOR'S AUTHORIZED SIGNATURE:	**DATE:**	E-MAIL:	

VALIDITY PERIOD

Offer shall be valid for at least sixty (60) days from date of bid opening, unless otherwise stated here: _____ days, or if extended by mutual agreement of the parties. Any withdrawal of this offer shall be made in writing, effective upon receipt by the agency issuing this IFB.

BID ACCEPTANCE

If your bid is accepted, all provisions of this IFB, along with the written results of any negotiations, shall constitute the written agreement between the parties ("Contract"). THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL GENERAL TERMS AND CONDITIONS are incorporated herein and shall apply. Depending upon the Goods or Services being offered, other terms and conditions may apply, as mutually agreed.

FOR STATE USE ONLY: Offer accepted and Contract awarded this ____ day of _____, 20____, as indicated on the attached certification, by _____

(Authorized Representative of [Enter Agency Title])

1.0 PURPOSE AND BACKGROUND

The intent of this solicitation is to award a contract for Pre-Purchasing Electrical Equipment Medium Voltage Switchgear for the University of North Carolina at Chapel Hill

1.1 CONTRACT TERM

Bids shall be submitted in accordance with the terms and conditions of this IFB and any addenda issued hereto.

2.0 GENERAL INFORMATION

2.1 INVITATION FOR BID DOCUMENT

The IFB is comprised of the base IFB document, any attachments, and any addenda released before Contract award, which are incorporated herein by reference.

2.2 E-PROCUREMENT FEE

This section was intentionally omitted.

2.3 NOTICE TO VENDORS REGARDING IFB TERMS AND CONDITIONS

It shall be the Vendor's responsibility to read the Instructions to Vendors, the University of North Carolina at Chapel Hill General Terms and Conditions, all relevant exhibits and attachments, and any other components made a part of this IFB and comply with all requirements and specifications herein. Vendors also are responsible for obtaining and complying with all Addenda and other changes that may be issued in connection with this IFB.

If Vendors have questions or issues, or exceptions regarding any component within this IFB, those must be submitted as questions in accordance with the instructions in the BID QUESTIONS Section. If the University determines that any changes will be made as a result of the questions asked, then such decisions will be communicated in the form of an IFB addendum. The University may also elect to leave open the possibility for later negotiation of specific provisions of the Contract that have been addressed during the question-and-answer period, prior to contact award.

Other than through this process or negotiation under 01 NCAC 05B.0503, the State rejects and will not be required to evaluate or consider any additional or modified terms and conditions submitted with Vendor's bid. This applies to any language appearing in or attached to the document as part of the Vendor's bid that purports to vary any terms and conditions or Vendors' instructions herein or to render the bid non-binding or subject to further negotiation. Vendor's bid shall constitute a firm offer that shall be held open for the period required herein ("Validity Period" above).

The University may exercise its discretion to consider Vendor proposed modifications. By execution and delivery of this IFB Response, the Vendor agrees that any additional or modified terms and conditions, whether submitted purposely or inadvertently, shall have no force or effect, and will be disregarded unless expressly agreed upon through negotiations

and incorporated by way of a Best and Final Offer (BAFO). Noncompliance with, or any attempt to alter or delete, this paragraph shall constitute sufficient grounds to reject Vendor's bid as non-responsive.

2.4 IFB SCHEDULE

The table below shows the *intended* schedule for this IFB. The State will make every effort to adhere to this schedule.

Event	Responsibility	Date and Time
Issue IFB	University	02-13-2025
Hold Pre-Bid Conference/Site Visit	University	N/A
Submit Written Questions	Vendor	02-27-2025 NLT 1:00 PM EST
Provide Responses to Questions	University	ASAP
Submit Bids	Vendor	03-07-2025 NLT 1:00 PM EST
Contract Award	University	ASAP
Contract Effective Date	University	TBD

BID QUESTIONS

Upon review of the IFB documents, Vendors may have questions to clarify or interpret the IFB in order to submit the best bid possible. To accommodate the Bid Questions process, Vendors shall submit any such questions by the "Submit Written Questions" date and time provided in the IFB SCHEDULE Section above, unless modified by Addendum.

Written questions shall be e-mailed to *mark_sillman@unc.edu* by the date and time specified above. Vendors will enter "IFB – 3000012132 – Company Name" as the subject for the email. **Questions shall be submitted as an MS WORD Document and shall include a reference to the applicable IFB section and be submitted in the format shown below:**

Reference	Vendor Question
IFB Section, Page Number	Vendor question …?

Questions received prior to the submission deadline date, the University's response, and any additional terms deemed necessary by the University will be posted in the form of an addendum to *the electronic Vendor Portal (eVP), https://evp.nc.gov,* and shall become an Addendum to this IFB. No information, instruction or advice provided orally or informally by any University personnel, whether made in response to a question or otherwise in connection with this IFB, shall be considered authoritative or binding. Vendors shall rely *only* on written material contained in an Addendum to this IFB.

2.7 BID SUBMITTAL

IMPORTANT NOTE: This is an absolute requirement. Vendor shall bear the risk of late submission due to unintended or unanticipated delay. It is the Vendor's sole responsibility to ensure its bid has been received as described in this IFB by the specified time and date of opening. The date and time of receipt will be marked on each bid when received. Any bid or portion thereof received after the bid submission deadline will be rejected.

[eVP]

All proposal responses shall be submitted electronically via the electronic Vendor Portal (eVP). Additional information can be found at the eVP updates for Vendors link: https://eprocurement.nc.gov/news-events/evp-updates-vendors.

Failure to submit a bid in strict accordance with these instructions shall constitute sufficient cause to reject a Vendor's bid(s). Vendors are strongly encouraged to allow sufficient time to upload bids.

Critical updated information may be included in Addenda to this IFB. It is important that all Vendors responding on this IFB periodically check the State's eVP website for any Addenda that may be issued prior to the bid opening date. All Vendors shall be deemed to have read and understood all information in this IFB and all Addenda thereto.

2.8 BID CONTENTS

Vendors shall populate all attachments of this IFB that require the Vendor to provide information and include an authorized signature where requested. Failure to provide all required items, or Vendor's submission of incomplete items, may result in the University rejecting Vendor's bid, in the University's sole discretion

Vendor IFB responses shall include the following items and attachments, which shall be arranged in the following order:

a) Primary Cover Letter, which must contain all of the following; (i) a statement that confirms that the Vendor has read the IFB in its entirety, including all links, and all Addenda released in conjunction with the IFB; (ii) a statement that the Vendor agrees to perform in accordance with the scope of work, requirements, and specifications contained herein; and (iii) Vendor's agreement to comply with all instructions, terms and conditions, and attachments.

b) Secondary Scope of Work required Cover Letter, see Scope of Work document attached.

c) Title Page: Include the company name, address, phone number and authorized representative along with the Bid Number.

d) Completed and signed version of EXECUTION PAGES, along with the body of the IFB.

e) Signed receipt pages of any addenda released in conjunction with this IFB, if required to be returned.

f) Vendor Response *[Indicate relative section references as a guide to responding to sections requiring additional responses outside of the solicitation document. If not required, delete.]*

g) Completed version of ATTACHMENT A: PRICING

h) Completed version of ATTACHMENT D: HUB SUPPLEMENTAL VENDOR INFORMATION

i) Completed version of ATTACHMENT E: CUSTOMER REFERENCE FORM

j) Completed version of ATTACHMENT F: LOCATION OF WORKERS UTILIZED BY VENDOR

k) Completed and signed version of ATTACHMENT G: CERTIFICATION OF FINANCIAL CONDITION

2.9 ALTERNATE BIDS

Unless provided otherwise in this IFB, Vendor may submit alternate bids for comparable Goods, various methods or levels of Service(s), or that propose different options. Alternate bids must specifically identify the IFB requirements and advantages addressed by the alternate bid. Any alternate bid, in addition to the marking described above, must be clearly marked with the legend: "Alternate Bid #___ *[for 'name of Vendor']*". Each bid must be for a specific set of Goods and Services and must include specific pricing. If a Vendor chooses to respond with various offerings, each must be offered with a separate price and be contained in a separate bid. Each bid must be complete and independent of other bids offered.

2.10 DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

Relevant definitions for this IFB are provided in 01 NCAC 05A .0112 and in the Instructions to Vendors referenced below which are incorporated herein by this reference.

3.0 METHOD OF AWARD AND BID EVALUATION PROCESS

3.1 METHOD OF AWARD

North Carolina G.S. 143-52 provides a general list of criteria the University shall use to award contracts, as supplemented by the additional criteria herein. The Goods or Services being procured shall dictate the application and order of criteria; however, all award decisions shall be in the University's best interest.

All responsive bids will be reviewed, and award or awards will be based on the responsive bid(s) offering the lowest price that meets the specifications to include any required verifications set out herein such as but not limited to past performance, references, and financial documents.

While the intent of this IFB is to award a Contract(s) to a single Vendor for all line items, the University reserves the right to make separate awards to different Vendors for one or more line items, to not award one or more line items or to cancel this IFB in its entirety without awarding a Contract, if it is considered to be most advantageous to the University to do so.

If a Vendor selected for award is determined by the University to be a non-resident of North Carolina, all responsive bids will be reviewed to determine if any of them were submitted by a North Carolina resident Vendor who requested an opportunity to match the price of the winning bid, pursuant to Executive Order #50 and G.S. 143-59 (for more information, please refer to ATTACHMENT H: VENDOR REQUEST FOR EXECUTIVE ORDER #50 PRICE MATCHING. If such bid(s) are identified, the University will then determine whether any such bid falls within the price-match range, and, if so, make a Contract award in accordance with the process that implements G.S. 143-59 and Executive Order #50.

The University reserves the right to waive any minor informality or technicality in bids received.

3.2 CONFIDENTIALITY AND PROHIBITED COMMUNICATIONS DURING EVALUATION

While this IFB is under evaluation, the responding Vendor, including any subcontractors and suppliers, is prohibited from engaging in conversations intended to influence the outcome of the evaluation. See Paragraph 29 of the Instructions to Vendors entitled COMMUNICATIONS BY VENDORS.

Each Vendor submitting a bid to this IFB, including its employees, agents, subcontractors, suppliers, subsidiaries and affiliates, is prohibited from having any communications with any person inside or outside the using agency; issuing agency; other government agency office or body (including the purchaser named above, any department secretary, agency head, members of the General Assembly and Governor's office); or private entity, if the communication refers to the content of Vendor's bid or qualifications, the content of another Vendor's proposal, another Vendor's qualifications or ability to perform a resulting contract, and/or the transmittal of any other communication of information that could be reasonably considered to have the effect of directly or indirectly influencing the evaluation of proposals, the award of a contract, or both.

Any Vendor not in compliance with this provision shall be disqualified from evaluation and award. A Vendor's proposal may be disqualified if its subcontractor and/or supplier engage in any of the foregoing communications during the time that the procurement is active (*i.e.*, the issuance date of the procurement until the date of contract award or cancellation of the procurement). Only those discussions, communications or transmittals of information authorized or initiated by the issuing agency for this IFB, or inquiries directed to the purchaser named in this IFB regarding requirements of the IFB (prior to proposal submission) or the status of the award (after submission) are excepted from this provision.

3.3 BID EVALUATION PROCESS

Only responsive submissions will be evaluated.

The University will conduct an evaluation of responsive Bids, as follows:

Bids will be received according to the method stated in the Bid Submittal section above.

All bids must be received by the issuing agency not later than the date and time specified in the IFB SCHEDULE Section above, unless modified by Addendum. Vendors are cautioned that this is a request for offers, not an offer or request to contract, and the University reserves the unqualified right to reject any and all offers at any time if such rejection is deemed to be in the best interest of the University.

At the date and time provided in the IFB SCHEDULE Section above, unless modified by Addendum, the bids from each responding Vendor will be opened publicly and all offers (except those that were previously withdrawn, or voided bids) will be tabulated. The tabulation shall be made public at the time it is created. When negotiations after receipt of bids is authorized pursuant to G.S. 143-49 and 01 NCAC 05B.0503, only the names of offerors and the Goods and Services offered shall be tabulated at the time of opening. If negotiation is anticipated, cost and price shall become available for public inspection at the time of the award. Interested parties are cautioned that these costs and their components are subject to further evaluation for completeness and correctness and therefore may not be an exact indicator of a vendor's pricing position.

At their option, the evaluators may request oral presentations or discussions with any or all Vendors for clarification or to amplify the materials presented in any part of the bid. Vendors are cautioned, however, that the evaluators are not required to request presentations or other clarification—and often do not. Therefore, all bids should be complete and reflect the most favorable terms available from the Vendor. Vendor Pricing in the bid cannot be altered or modified as part of a clarification.

Bids will generally be evaluated, based on completeness, content, cost and responsibility of the Vendor to supply the requested Goods and Services. Specific evaluation criteria are listed in Section 3.1 METHOD OF AWARD.

Upon completion of the evaluation process, the University will make Award(s) based on the evaluation and post the award(s) to the State's eVP website under the IFB number for this solicitation. Award of a Contract to one Vendor does not mean that the other bids lacked merit, but that, all factors considered, the selected bid was deemed most advantageous and represented the best value to the University.

The University reserves the right to negotiate with one or more Vendors, or to reject all original offers and negotiate with one or more sources of supply that may be capable of satisfying the requirement, and in either case to require Vendor to submit a Best and Final Offer (BAFO) based on discussions and negotiations with the University.

3.4 PERFORMANCE OUTSIDE THE UNITED STATES

Vendor shall complete ATTACHMENT F: LOCATION OF WORKERS UTILIZED BY VENDOR. In addition to any other evaluation criteria identified in this IFB, the University may also consider, for purposes of evaluating proposed or actual contract performance outside of the United States, how that performance may affect the following factors to ensure that any award will be in the best interest of the University:

a) Total cost to the University
b) Level of quality provided by the Vendor
c) Process and performance capability across multiple jurisdictions
d) Protection of the University's information and intellectual property
e) Availability of pertinent skills
f) Ability to understand the University's business requirements and internal operational culture
g) Particular risk factors such as the security of the University's information technology
h) Relations with citizens and employees
i) Contract enforcement jurisdictional issues

3.5 INTERPRETATION OF TERMS AND PHRASES

This IFB serves two functions: (1) to advise potential Vendors of the parameters of the solution being sought by the University; and (2) to provide (together with other specified documents) the terms of the Contract resulting from this procurement. The use of phrases such as "shall," "must," and "requirements" are intended to create enforceable contract conditions. In determining whether bids should be evaluated or rejected, the University will take into consideration the degree to which Vendors have proposed or failed to propose solutions that will satisfy the University's needs as described in the IFB. Except as specifically stated in the IFB, no one requirement shall automatically disqualify a Vendor from consideration. However, failure to comply with any single requirement may result in the University exercising its discretion to reject a bid in its entirety.

4.0 REQUIREMENTS

This Section lists the requirements related to this IFB. By submitting a bid, the Vendor agrees to meet all stated requirements in this Section, as well as any other specifications, requirements, and terms and conditions stated in this IFB. If a Vendor is unclear about a requirement or specification or believes a change in a requirement would allow for the University to receive a better bid, the Vendor is encouraged to submit these items in the form of a question during the question and answer period in accordance with the Bid Questions Section above.

SEE SCOPE OF WORK DOCUMENT ATTACHED

4.1 PRICING

Bid price shall constitute the total cost to the University for delivery fully assembled and ready for use, including all applicable charges for shipping, delivery, handling, administrative and other similar fees. Complete ATTACHMENT A: PRICING FORM and include in Vendor's response.

4.2 ESTIMATED QUANTITIES

This section was intentionally omitted.

4.3 PRODUCT IDENTIFICATION

SUITABILITY FOR INTENDED USE

Vendors are requested to offer only items directly complying with the specifications herein or comparable items which will provide the equivalent capabilities, features and diversity called for herein. The University reserves the right to evaluate all bids for suitability for the required use and to award the one best meeting requirements and considered to be in the University's best interest.

4.4 TRANSPORTATION AND IDENTIFICATION

The Vendor shall deliver Free-On-Board (FOB) Destination to any requested location within the State of North Carolina with all transportation costs and fees included in the total bid price.

When an order is placed using a purchase order, the purchase order number shall be shown on all packages and shipping manifests to ensure proper identification and payment of invoices. If an order is placed without using a purchase order, such as via phone, the Buyer's name shall be show on all packages. A complete packing list shall accompany each shipment. Vendors shall not ship any products until they have received an order.

4.5 DELIVERY

The Vendor shall deliver Free-On-Board (FOB) Destination to the following location(s):

For completion by Vendor: Delivery will be made from _____ (city, state) within _____ consecutive calendar days after receipt of purchase order. Promptness of delivery may be used as a factor in the award criteria.

Delivery shall not be considered to have occurred until installation has been completed. Upon completion of the installation, the Vendor shall remove and properly dispose of all waste and debris from the installation site. The Vendor shall be responsible for leaving the installation area clean and ready to use.

4.6 AUTHORIZED RESELLER

The Vendor shall be authorized by the manufacturer to distribute or resell the products and/or maintenance offered in this IFB. The Vendor shall provide a signed statement from the manufacturer confirming authorization with its bid response. Failure to provide this statement shall constitute sufficient grounds for rejection of Vendor's offer, at the discretion of the University.

Vendor is the: ☐ **Manufacturer** ☐ **Dealer** ☐ **Reseller** ☐ **Distributor**

Authorized: ☐ **Yes** ☐ **No** **Attached Manufacturer's Authority:** ☐ **Yes** ☐ **No**

4.7 WARRANTY

Vendor warrants that all equipment furnished under this IFB will be newly manufactured, of good material and workmanship. The warranty will apply from the date equipment is put into operation for a minimum period of at least twelve (12) months or the length of the manufacturer's warranty, whichever is longer. Such a warranty shall cover the cost of all defective parts replacement, labor, freight, and technicians' travel at no additional cost to the University, or as specified by the Purchasing Agency herein. To the extent not superseded by the terms of this paragraph, manufacturer's warranty terms shall apply. The Vendor's warranty shall be at least the level of coverage provided for its comparable customers.

The report of a problem does not presuppose that every call must result in an "on-site" visit for service/repair. The Vendor and/or service sub-contractor shall utilize best efforts to resolve problems in a timely fashion by using acceptable servicing methods to include, but not limited to, verbal problem analysis and remote diagnosis. The warranty requirement does not impose any additional duty on the University to make other than normal and good faith problem resolution efforts or expenditures of time. The vendor shall be responsible for compliance with warranty terms by any third-party service provider. The vendor shall provide contact information for the warranty service provider, below.

Vendor is authorized by manufacturer to repair equipment offered during the warranty period? ☐ YES ☐ NO

Will the Vendor provide a warranty service? ☐ YES ☐ NO, a manufacturer-authorized third party will perform warranty service.

Contact information for warranty service provider:

Company Name: _____

Company Address: _____

_____

Contact Person (name): _____

Contact Person (phone number): _____

Contact Person (email): _____

4.8 MAINTENANCE OPTION

Following expiration of the above warranty, Vendor, or its third-party service provider, shall maintain the system specifications and performance level in accordance with the manufacturer's published specifications and those of this IFB. Maintenance shall include all parts, remedial maintenance labor, travel and living expenses incurred. Except as specifically provided for elsewhere herein, coverage shall be at least for 8:00 am ET to 5:00 pm ET, Monday through Friday, except university recognized holidays and shall include a minimum of two (2) preventive and safety maintenance inspections per year. The University shall have the option to accept the maintenance coverage in this paragraph at the price offered in ATTACHMENT A: PRICING of this IFB, if applicable.

4.9 [SAMPLES] [DEMONSTRATION] [DESCRIPTIVE LITERATURE]

This section was intentionally omitted.

4.10 HUB PARTICIPATION

Pursuant to North Carolina General Statute G.S. 143-48, it is State policy to encourage and promote the use of small, minority, physically handicapped, and women contractors in purchasing Goods and Services. As such, this IFB will serve to identify those Vendors that are minority owned or have a strategic plan to support the State's Historically Underutilized Business program by meeting or exceeding the goal of 10% utilization of diverse firms as 1st or 2nd tier subcontractors. Vendor shall complete ATTACHMENT D: HUB SUPPLEMENTAL VENDOR INFORMATION.

4.11 REFERENCES

Vendors shall provide at least three (3) references, using ATTACHMENT E: CUSTOMER REFERENCE FORM, for which your company has supplied the exact model of equipment offered. The University *may* contact these users to determine the quality level of the offered equipment; as well as, but not limited to user satisfaction with Vendor performance. Information obtained *may* be considered in the evaluation of the bid.

4.12 VENDOR'S REPRESENTATIONS

If the bid results in an award, Vendor agrees that it will not enter any agreement with a third party that may abridge any rights of the University under the Contract. If any Services, deliverables, functions, or responsibilities not specifically described in this solicitation are required for Vendor's proper performance, provision and delivery of the Service and deliverables under a resulting Contract, or are an inherent part of or necessary sub-task included within such service, they will be deemed to be implied by and included within the scope of the contract to the same extent and in the same manner as if specifically described in the Contract. Unless otherwise expressly provided herein, Vendor will furnish all of its own necessary management, supervision, labor, facilities, furniture, computer and telecommunications equipment, software, supplies and materials necessary for the Vendor to provide and deliver the Services and/or other Deliverables.

4.13 FINANCIAL STABILITY

As a condition of contract award, the Vendor must certify that it has the financial capacity to perform and to continue to perform its obligations under the Contract; that Vendor has no constructive or actual knowledge of an actual or potential legal proceeding being brought against Vendor that could materially adversely affect performance of this Contract; and that entering into this Contract is not prohibited by any contract, or order by any court of competent jurisdiction

Each Vendor shall certify it is financially stable by completing the ATTACHMENT G: CERTIFICATION OF FINANCIAL CONDITION. The University is requiring this certification to minimize potential performance issues from contracting with a Vendor that is financially unstable. This Certification shall be deemed continuing, and from the date of the Certification to the expiration of the Contract, the Vendor shall notify the University within thirty (30) days of any occurrence or condition that materially alters the truth of any statement made in this Certification.

4.14 AGENCY INSURANCE REQUIREMENTS MODIFICATION

This section was intentionally omitted.

4.15 NC COVID-19 VACCINATION AND TESTING REQUIREMENT

This section was intentionally omitted.

4.16 FEDERAL COVID-19 VACCINATION REQUIREMENT

This section was intentionally omitted.

4.17 LOBBYING ACTIVITY CERTIFICATION FOR FEDERAL GRANTS

This section was intentionally omitted.

5.0 PRODUCT SPECIFICATIONS

5.1 SPECIFICATIONS

See the Scope of Work document, Chilled Water Infrastructure Expansion East Chiller Plant

SCO ID 22-25588-02G, Code: 42123-355 / 42323-305

UNC Bldg. No. 505

Pre-purchased Equipment, Cooling Towers

VENDOR'S RESPONSE

Item #	***Specifications***	**Product/Service Offered Meets Specification**
		☐ YES ☐ NO
		☐ YES ☐ NO

5.2 CERTIFICATION AND SAFETY LABELS

All manufactured items and/or fabricated assemblies subject to operation under pressure, operation by connection to an electric source, or operation involving a connection to a manufactured, natural, or LP gas source shall be constructed and approved in a manner acceptable to the appropriate state inspector which customarily requires the label or re-examination listing or identification marking of the appropriate safety standard organization; such as the American Society of Mechanical Engineers for pressure vessels; the Underwriters Laboratories and /or National Electrical Manufacturers' Association for electrically operated assemblies; or the American Gas Association for gas operated assemblies, where such approvals of listings have been established for the type of device offered and furnished. Further, all items furnished shall meet all requirements of the Occupational Safety and Health Act (OSHA), and state and federal requirements relating to clean air and water pollution.

5.3 DEVIATIONS

The nature of all deviations from the Specifications listed herein shall be clearly described by the Vendor. Otherwise, it will be considered that items offered by the Vendor are in strict compliance with the Specifications provided herein, and the successful Vendor shall be required to supply conforming goods. Deviations shall be explained in detail on an attached sheet. However, no implication is made or intended by the University that any deviation will be acceptable. Do not list objections to the North Carolina General Terms and Conditions in this section.

6.0 CONTRACT ADMINISTRATION

All Contract Administration requirements are conditioned on an award resulting from this solicitation. This information is provided for the Vendor's planning purposes

6.1 CONTRACT MANAGER AND CUSTOMER SERVICE

This section was intentionally omitted.

6.2 POST AWARD PROJECT REVIEW MEETINGS

This section was intentionally omitted.

6.3 CONTINUOUS IMPROVEMENT

This section was intentionally omitted.

6.4 PERIODIC STATUS REPORTS

This section was intentionally omitted.

6.5 ACCEPTANCE OF WORK

Performance of the work and delivery of Goods shall be conducted and completed at least in accordance with the Contract requirements and recognized and customarily accepted industry practices. Performance shall be considered complete when the Services or Goods are approved as acceptable by the Contract Administrator.

6.6 INVOICES

The vendor shall invoice the Purchasing Agency. The standard format for invoicing shall be Single Invoices meaning that the Vendor shall provide the Purchasing Agency with an invoice for each order. Invoices shall include detailed line item information to allow the Purchasing Agency to verify pricing at point of receipt matches the correct price from the original date of order. At a minimum, the following fields shall be included on all invoices:

Vendor's Billing Address, Customer Account Number, NC Contract Number, Order Date, Buyer's Order Number, Manufacturer Part Numbers, Vendor Part Numbers, Item Descriptions, Price, Quantity, and Unit of Measure.

INVOICES MAY NOT BE PAID UNTIL AN INSPECTION HAS OCCURRED AND THE GOODS ACCEPTED.

6.7 DISPUTE RESOLUTION

During the performance of the Contract, the Parties agree that it is in their mutual interest to resolve disputes informally. Any claims by the Vendor shall be submitted in writing to the University's Contract Manager for a resolution. Any claims by the University shall be submitted in writing to the Vendor's Project Manager for a resolution. The Parties shall agree to negotiate in good faith and use all reasonable efforts to resolve such dispute(s).

During the time the Parties are attempting to resolve any dispute, each shall proceed diligently to perform their respective duties and responsibilities under this Contract. The Parties will agree on a reasonable amount of time to resolve a dispute. If a dispute cannot be resolved between the Parties within the agreed upon period, either Party may elect to exercise any other remedies available under the Contract, or at law. This provision, when agreed in the Contract, shall not constitute an agreement by either party to mediate or arbitrate any dispute.

6.8 PRODUCT RECALL

Vendor expressly assumes full responsibility for prompt notification to the Buyer listed on the face of this IFB of any product recall in accordance with the applicable state or federal regulations. The Vendor shall support the University, as necessary, to promptly replace any such products, at no cost to the University.

6.9 CONTRACT CHANGES

Contract changes, if any, over the life of the Contract shall be implemented by contract amendments agreed to in writing by the University and Vendor. Amendments to the contract can only be made through the contract administrator.

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7.0 ATTACHMENTS

IMPORTANT NOTICE

RETURN THE REQUIRED ATTACHMENTS WITH YOUR RESPONSE

FOLLOW THE LINKS TO ACCESS EACH ATTACHMENT

ATTACHMENT A: PRICING (No actual attachment, see below)

Complete and return the Pricing associated with this IFB by submitting all costs including transportation on a standard company quote document with a line for "TOTAL COST TO THE UNIVERSITY".

ATTACHMENT B: INSTRUCTIONS TO VENDORS

The Instructions to Vendors, which are incorporated herein by this reference, may be found here:

https://finance.unc.edu/departments/purchasing/bidders-instructions/

ATTACHMENT C: NORTH CAROLINA GENERAL TERMS & CONDITIONS

The University of North Carolina at Chapel Hill General Terms and Conditions, which are incorporated herein by this reference, may be found here:

https://finance.unc.edu/departments/purchasing/terms-products/

ATTACHMENT D: HUB SUPPLEMENTAL VENDOR INFORMATION

Complete and return the Historically Underutilized Businesses (HUB) Vendor Information form, which can be found at the following link:

https://www.doa.nc.gov/pandc/onlineforms/form-hub-supplemental-vendor-information-9-2021/download

ATTACHMENT E: CUSTOMER REFERENCE FORM

Complete and return the Customer Reference Form, which can be found at the following link:

https://ncadmin.nc.gov/media/15503/open

ATTACHMENT F: LOCATION OF WORKERS UTILIZED BY VENDOR

Complete and return the Location of Workers Utilized by Vendor, which can be found at the following link:

https://www.doa.nc.gov/pandc/onlineforms/form-location-workers-09-2021/download

ATTACHMENT G: CERTIFICATION OF FINANCIAL CONDITION

Complete, sign, and return the Certification of Financial Condition, which can be found at the following link:

https://www.doa.nc.gov/pandc/onlineforms/form-certification-financial-condition-09-2021/download

***** Failure to Return the Required Attachments May Eliminate Your Response from Further Consideration *****

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Chilled Water Infrastructure Expansion East Chiller Plant

SCO ID 22-25588-02G, Code: 42123-355 / 42323-305
UNC Bldg. No. 505

Prepurchased Equipment Cooling Towers Bid Set

Submitted by:

Affiliated Engineers

1414 Raleigh Road, Suite 305
Chapel Hill, North Carolina 27517
(919) 419-9802
License No. C-2982

AEI Project No. 23480-02

December 16, 2024

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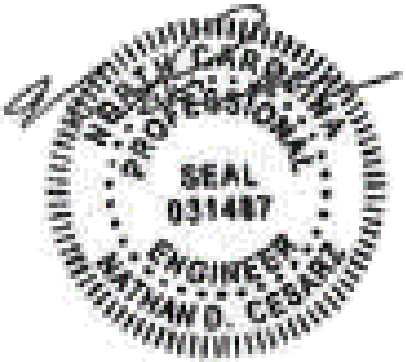

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SECTION 23 0514
PROCESS VARIABLE FREQUENCY DRIVE (VFD) SYSTEM

PART 1 - GENERAL

1.1 OWNER PRE-PURCHASED EQUIPMENT

A. This equipment will be prepurchased by the Owner with the cooling tower and furnished to the successful Contractor after award for expediting delivery and installation as if the Contractor purchased the equipment directly.

B. Owner will make available manufacturer provided shop drawings of Owner prepurchased equipment for review by the Contractor. Contractor shall review shop drawings to ascertain that Contractor has included necessary labor and materials to install equipment and complete system it serves.

C. Contractor shall be responsible for arranging/coordinating delivery of Owner prepurchased equipment and all other related logistics and activities. This includes directing the delivery truck to the jobsite, coordinating the date and time of delivery, and receipt of the equipment at the jobsite. Manufacturer is responsible for equipment until it is unloaded at the jobsite by the Contractor.

D. Contractor shall install Owner prepurchased equipment and all appurtenances. This shall include, but not be limited to; unloading, rigging and setting equipment in place, making connections, starting, testing and installing equipment in accordance with manufacturer's recommendations, and maintaining equipment until such time as project is accepted by Owner. Perform all work and provide materials and connections for Owner furnished equipment in accordance with drawings and scope of work under all related specifications.

E. The following summarizes the general responsibilities of the equipment manufacturer:

1. Provide shop drawings and submittal data.
2. Manufacture and delivery of equipment including coordination of exact delivery date and supervision of rigging, unloading, and setting.
3. Lead equipment check-out, testing, and start-up process and submit report(s).
4. Provide touch up paint.
5. Provide O&M documentation.
6. Provide Owner training and participate in commissioning process.

1.2 SCHEDULE

A. Schedule:

1. The following schedule is anticipated relative to the prepurchased equipment delivery, installation and activation. This is a preliminary schedule and exact dates are to be coordinated with the Owner and Contractor.
   a. Cooling Tower Basin Complete:.... October 2025
   b. Tower Materials Delivery and Erection: October 2025 – February 2026
   c. Installation Work By Contractor:.... February – October 2026

d. Start-Up & Commissioning: ..... October – November 2026
e. Vibration and Acoustical Testing ... November 2026
f. Thermal Performance Testing ..... July 2027

B. Contractor shall plan construction to allow for equipment to be received and installed at the job site within the above delivery window. If Contractor is unable to install equipment upon coordinated delivery date(s), it is the Contractor's responsibility to provide appropriate storage for equipment, local to the University, and provide transportation of equipment from storage site to job site.

1.3 SYSTEM DESCRIPTION

A. Provide Variable Frequency Drives (VFD) for each pump, fan or other driven equipment sized to accommodate motors shown on drawings or schedules. Provide all VFDs from same manufacturer for pumps and cooling tower fans respectively. Refer to the mechanical drawings for the VFD schedule.

B. VFD manufacturer shall review driven equipment and motors for VFD compatibility. Submit written statement from manufacturer of driven equipment along with VFD shop drawing submittals, indicating verification of compatibility.

C. VFD shall vary speed of its respective fan, pump or other driven equipment motor in response to either 4-20 mA control signal provided by Controls Contractor.

D. VFD system shall consist of the following:
1. Variable frequency drive(s).
2. UL Listed disconnect device.
3. NEC recognized disconnect device (circuit breaker).
4. Internal reactor with minimum 5% impedance or equivalent input line reactor.
5. Operator keypad and display unit.
6. All components shall be in a common enclosure with single point wiring.
7. All auxiliary power shall be derived locally from a CPT inside the enclosure.
8. Provide internal fan(s) for cooling.

E. Drives shall have SCCR (short circuit current rating) of 65 kA.

F. All VFD system components, including (but not limited to) input filters, drive, output filters, harmonic filters, etc. shall be located within a common enclosure, with a single point electrical connection for supply wiring and a single point electrical connection for wiring to load (motor). Enclosure shall be properly sized and equipped with fans for cooling all components required.

1.4 QUALIFICATIONS

A. VFD system shall be furnished by a manufacturer with at least 10 years experience in design, construction and application of VFD equipment.

1.5 BID SUBMITTALS

A. The following shall be provided with the equipment bid proposal:
   1. Cover letter with compliance table listing each specification section and indicating compliance “C”, deviation for alternate “D”, or exception with explanation “E”. Any deviation or exception shall be accompanied with detailed explanation of how design intent is being upheld for evaluation by the Owner and Designer.
   2. Product data including:
      a. Manufacturer's name
      b. Identification of system components
      c. Type of enclosure, dimensioned front elevation and plan view, equipment weight, conduit and cabling access locations.
      d. Physical installation requirements for service access and ventilation.
      e. Capacities/ratings/SCCR
      f. System wiring and block diagram showing system components.

B. References: a complete list of references shall be provided with each Proposal. The list shall include a minimum of five (5) references where equipment of similar manufacturer type and capacity has been installed. The list shall indicate the name of the facility where the equipment has been installed, location (city and state) of the equipment, installation date, equipment capacity, contact name and contact telephone number of each reference.

C. Scheduled Maintenance Requirements: A complete list of the recommended scheduled maintenance requirements for the equipment shall be provided with each Proposal. The list shall identify each recommended service item and its recommended frequency (monthly, quarterly, etc.). The list shall, at a minimum, include the scheduled maintenance items identified.

D. Other information to verify compliance with the Invitation for Bids.

E. Award will be based on specification compliance and best overall value for the Owner.

1.6 FABRICATION SUBMITTALS

A. Product Data for each VFD system including the following:
   1. Complete technical description of the VFD system.
   2. Manufacturer's name.
   3. Identification of system components.
   4. 3-Wire system wiring and block diagram showing all system components.
   5. LV controls wiring schematic, terminations, DI/DO/AI/AO points, interface requirements with DCS system via MODBUS TCP/IP.
   6. Type of enclosure, dimensioned front elevation and plan view, equipment weight, conduit access locations.
   7. Physical installation requirements for access and ventilation.
   8. Capacities/ratings/SCCR.

9. Cabling entry/exit and size requirements.
10. System wiring and block diagram showing system components.
11. Performance, control and protection data with specified features clearly shown.
12. Operating and monitoring devices with specified features clearly indicated.
13. Manufacturer's installation instructions.
14. Start-up operation, maintenance, spare parts, and field tests.
15. Other appropriate data.

B. After quality assurance tests are complete, submit written certification that drive and components have passed factory quality assurance tests.

C. Submit product and performance data on electrical noise attenuation device if required to meet electrical noise criteria specified. Isolation transformer is not electrical noise attenuation device.

D. Submit printed list of settings for all items that require setting during startup or list of Factory Default Parameters.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
1. Include manufacturer’s recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.
2. Include manufacturer’s written instructions for testing and adjusting system.
3. Include spare parts data listing, source, and current prices of replacement parts and supplies.
4. Include copy of equipment warranty.

1.8 SPARE PARTS

A. Three (3) spare fuses for each size or type of VFD.

B. One (1) spare enclosure cooling fan for each different type of drive.

C. Three (3) spare sets of ventilation air filters for each drive.

D. One (1) spare key pad/touch screen for each different type of drive.

1.9 WARRANTY

A. Manufacturer shall provide a five year warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of project final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: ABB, Danfoss, Yaskawa

2.2 VFD DESCRIPTION

A. Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection, arranged to provide self-protection, and variable-speed control of one three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Units shall be fully rated to withstand integrated short-circuit current.

2.3 FABRICATION

A. VFD shall be of a fixed DC bus type with a full wave input diode bridge. The VFD shall convert 3 phase 60 Hz input power to three phase adjustable voltage, adjustable frequency output power using Pulse Width Modulation (PWM) switching techniques and third generation I.G.B.T.'s.

B. VFD shall be variable torque, solid state, microprocessor-based control, modular design for standard induction AC motor.

C. For maintenance purposes, VFD shall be capable of stable operation, (starting, stopping and running), with the motor completely disconnected (no load).

D. Refer to the VFD schedule for maximum dimensions for the enclosure as well as cable entry/exit requirements.

E. VFD shall be capable of operating any standard "off-the-shelf" squirrel cage induction motor with a full load rating within the capacity of the VFD. Therefore, at any time in the future it shall be possible to install a standard new or rewound motor in the field without requiring modification of the VFD.

F. Circuitry shall be plug-in, plug-out modular. Printed circuit boards shall have protective coating to reduce corrosion.

G. Complete unit shall conform to NEMA and NEC standards and control circuitry shall be electrically isolated from power circuitry. Entire assembly panel shall be third party listed. Third party agency shall be amongst those accredited by the North Carolina Building Code Council (NCBCC) to label electrical and mechanical equipment. https://www.ncosfm.gov/codes/state-electrical-division/qualified-testing-laboratories

H. Provide control power transformer to serve enclosure auxiliary power requirements.

2.4 PERFORMANCE REQUIREMENTS

A. Input: 460 (+10%, -10%) VAC, 3 Ph, 60 (± 2) Hz

B. Output: 460 VAC, 3 Ph, 10 to 60 Hz

C. Operating Environment: VFD Manufacturer shall rate VFDs for specific environment in which they will operate.
   1. Ambient temperature:
      a. Indoor applications: 14°F to 104°F
   2. Relative humidity: 95% non-condensing
   3. Elevation above sea level: 0 ft to 3280 ft

D. Linear acceleration and deceleration adjustable from 5 to 60 seconds. Provide adjustable v/Hz ratio and low speed boost features.

E. Output Current Rating: Continuous full load output current rating of drive shall not be less than that listed for motor of equivalent horsepower in NEC table 430-150.

F. Drive overload capacity to be minimum 110% of motor FLA based on NEC ratings for one minute.

G. Time to Shutdown: Inversely proportional to square of overload current ($t = k/I^2$).

H. Motor Regeneration Protection: Unit shall have capacity of dissipating regeneration energy up to VFD current rating without damage to or shutdown of drive. Unit shall be capable of starting into rotating load.

I. Output Frequency Stability: ± 0.5% of base frequency in 24 h throughout range of rated operating conditions.

J. Output Voltage Regulation: ± 2% of maximum rated output voltage.

K. Output voltage rise time shall be no faster than 1000 V/micro sec measured at the motor terminals.

L. Power Loss Ride-Through: 1 cycle.

M. Linearity (speed reference to output frequency): ±1.0%

N. Input Power Factor: Minimum of 0.95 regardless of speed and load.

O. Minimum drive efficiency as percent of input power shall be as follows:

Percent Load	Frequency (Hz)			
	60	50	30	15
100	97	96	95	90
75	97	96	94	90
50	97	96	94	90
25	96	95	91	84

2.5 CONTROL FEATURES

A. VFD shall have a door mounted digital operator interface with an 8-Line, 32-character HOA LCD display providing readout functions that include output frequency, output voltage, output current, output power, DC bus voltage, interface terminal status, PI feedback and fault status.

B. Main Printed Circuit Board (PCB) must be common throughout the various horsepower models. The main PCB must be able to be quickly removed from the drive chassis via the use of plug-in connectors and removable terminal blocks.

C. Main PCB must have at least three programmable multi-function output relays (Form A or Form C, rated 2 A @ 250 VAC & 30 VDC)VFD shall have an enclosure constructed from metal to reduce E.M.I.

D. Main PCB shall be constructed with isolated control circuitry.

E. VFD must have bi-directional auto-speed search for starting into rotating loads spinning in any direction and returning the motor is desired speed in the proper direction.

F. VFD speed control circuit shall accept either 4-20 mA DC isolated ungrounded transmitter signal in automatic mode and from manual speed control keypad in manual mode.

G. Provide adjustable minimum and maximum speed settings (0 - 100%) for both auto and manual mode. Initial minimum setting shall be 25%.

H. Provide adjustable automatic reset for fault trips, except short circuit type faults. After selected number of unsuccessful restart attempts, drive shall be shut down. Number of restart attempts and time interval between resets shall be selective.

I. When unit shuts down due to power outage, unit shall be capable of being restarted manually or automatically.

J. VFD shall be capable of starting into rotating loads spinning in any direction.

K. Provide critical frequency avoidance circuit with at least 3 field adjustable bands to avoid operation at speeds, which cause excessive vibration in driven equipment.

L. Minimum drive efficiency as percent of input power shall be as follows: 96% at half-speed; 98% at full-speed.

M. Provide drive with provisions to accept an ungrounded 4-20 mA output signal.

N. For exposed outdoor motors VFD controller shall receive signals from motor winding thermostats to shut motor off due to overheating and energize 120V motor heater based on run status and low winding temperature to prevent internal motor condensation.

2.6 INTEGRATION WITH DISTRIBUTED CONTROL SYSTEM (DCS)

A. Furnish each VFD with digital communication bus card for connection to DCS use via MODBUS TCP/IP. No third-party translator is permitted. Coordinate with Control Contractor for specific interface requirement.

B. The VFD shall be capable of communicating all available information all operational and safety information/control information that VFD utilizes to operate to the DCS including Manual-Off-Automatic status.

C. Provide four pre-programmed relay/contacts for remote output indication of VFD fault condition, motor run status based on current or torque above minimum threshold, and one spare.

D. In addition to the above communication, the VFD shall be capable of communicating the following hard wired input/output signals with the DCS. Provide all required wiring, relays, contacts, terminal strips, etc. to support this communication.
   1. VFD start/stop
   2. VFD status
   3. VFD fault
   4. VFD speed
   5. Motor kW
   6. Forward Rotation (Cooling Towers Only)
   7. Reverse Rotation (Cooling Towers Only)

2.7 PROTECTION FEATURES

A. Power circuits shall be protected by electronic protection circuits. Electronic protection circuits shall provide orderly shutdown without blowing fuses and prevent component loss under the following abnormal conditions.
   1. Overcurrent protection shall be via circuit breaker. The use of fused disconnect is not allowed.
   2. Instantaneous overcurrent and over voltage trip of output.
   3. Solid state protective circuit shall provide NEC motor running overload protection tested in accordance with UL 991.
   4. Power line overvoltage or undervoltage.
   5. Phase sequence detection or insensitivity to incoming power phase sequence.
   6. Single and 3 Ph short circuit protection.
   7. Control circuit malfunction.
   8. Overtemperature.
   9. Ground fault for all 3 phases.

B. VFD shall protect itself from damage due to phase-to-phase or phase-to-ground faults without fuse blowing or use of isolation transformers. VFDs which require isolation transformers to provide ground fault protection are not acceptable.

C. In addition, provide the following protection features.
   1. Input line-to-line and line-to-ground transient protection
   2. Control circuit transformer fusing.
   3. Grounded control chassis.
   4. Diagnostic indication.

D. VFD shall employ adjustable torque limit control, which shall override speed command and decrease frequency while maintaining correct volts/hertz ratio whenever load level surpasses VFD design level or set point.

E. VFD shall employ adjustable torque limit control which shall override the speed command and decrease the frequency while maintaining the correct volts/hertz ratio whenever the load level surpasses the VFD design level or set point.

F. The AC drive shall have a minimum AC undervoltage power loss ride-through of 200 msec.

2.8 OPERATING AND MONITORING DEVICES

A. The following functionality shall be provided and may be controlled via touchscreen/keypad:
   1. Hand-Off-Auto device.
   2. Operating mode selector device marked "Hand-Off-Auto".
   3. Manual speed control keypad.
   4. Power on indication.
   5. Drive run indication.
   6. Drive fault indication with testable feature.
   7. Fault reset device.

B. Speed indicating meter or digital indication (0 - 100%) calibrated in percent speed or frequency meter with 0 to 90 Hz scale to indicate motor speed.

C. Integral digital programming and operating display which shows Hz, Percent Output Current, Output Voltage, Percent Output Power, Operating Parameters and their values, and Diagnostic Fault Codes. In addition, Keypads shall be incorporated to facilitate digital programming of drive adjustments. Analog potentiometer adjustments are not acceptable.

D. Provision shall be included to provide selectable programming security by inhibiting program parameter changes with password security.

E. Control shall incorporate microprocessors for operator interface, diagnostics, and fault managements, and power management.

F. Optional programming software, which includes provision for serial communication with drive, shall be available for shipment at time of equipment order placement.

G. Fault buffers to sequentially store last four faults. Parameter and fault information to be stored in non-volatile memory.

2.9 QUALITY ASSURANCE TESTS

A. Complete drive assembly shall be factory tested with actual AC induction motor, 100% load and temperature cycled within environment chamber at 104°F. Documentation of test shall be furnished to verify successful completion of test at Engineer's request.

2.10 DISCONNECT DEVICE

A. Provide integral switch to disconnect incoming electrical power to units. Disconnect device shall be UL Listed devices:
   1. Enclosed molded case breaker; ampere rated and providing over current protection

B. Disconnect device shall be capable of being padlocked in OFF position and complying with OSHA Requirements. Operating handle shall indicate whether switch is “ON” or “OFF”.

C. Switch shall have cover interlock to prevent unauthorized opening of switch door when handle is in “ON” position and to prevent closing of switch mechanism with door open. Provide defeater mechanism to defeat the interlock for user required access.

2.11 INPUT LINE REACTORS

A. Series line reactors shall be designed for harmonic filtering service and shall be UL component recognized. Construction shall be copper wire wound on steel cores. Inductors shall be 3-phase. Design maximum temperature rise for inductors shall be 239°F.

B. Inductors shall be air-gapped to avoid saturation. Inductance shall be measured under full load and shall be within ±5% of design value.

C. Line reactor shall be included integral to drive enclosure.
   1. Where mounting line reactor in VFD enclosure is not possible, enclosure shall be steel with enamel finish and no knockouts. Enclosure shall match construction of VFD enclosure and shall have hinged lockable cover. Screened openings shall be provided for enclosure ventilation. Enclosure shall be built with integral mounting brackets for platform or wall mounting. Coordinate location with other trades. Provide disconnect switch for line side filters.

D. Internal DC bus chokes are acceptable when providing equivalent performance to AC line reactors specified.

PART 3 – EXECUTION – BY THE EQUIPMENT MANUFACTURER

3.1 START-UP

A. Provide services of factory trained engineer or technician to approve installation; start-up test and adjust for proper operation.

B. Should drive operation be deficient, make changes necessary to bring units into compliance with specified performance requirements. Cost of changes and retest shall be borne by drive manufacturer.

C. Upon completion of this service, submit report signed by manufacturer's service representative, including start-up and test log.

3.2 TRAINING

A. The equipment manufacturer shall provide full operating, service and maintenance training programs for the Owner's maintenance personnel. All costs associated with Owner Training shall be included in the base proposal, including travel and per diem expenses. Training shall occur at the Owners facility. Training will be scheduled separately at a time determined by the Owner.

B. Training shall only occur after the systems provided are installed by the Contractor, started up by the Manufacturer, and made ready for proper operation.

C. Manufacturer shall instruct and train Owner's representative in operation and maintenance and participate in any commissioning of each system provided for the project.

D. A complete syllabus and O&M Manuals shall be submitted and approved by Owner four weeks prior to training.

E. Include minimum of 8 hours of start-up and Owner training and a minimum of an additional 8 hours of commissioning support time for each system.

F. Owner may video tape training sessions for their use in future training of their operations and maintenance staff.

PART 4 – EXECUTION - BY THE INSTALLING CONTRACTOR

4.1 INSPECTION

A. Visually inspect equipment and components at time of delivery. Submit report to Owner and Designer with list of items or deficiencies to be corrected.

4.2 PROTECTION

A. Protect VFD cabinets from dust/dirt during storage and operation until turned over to Owner.

B. If VFDs are not furnished with internal air filter racks, provide temporary filter media to protect VFD cabinets and replace filter media as required.

4.3 INSTALLATION

A. Install VFD system in accordance with details, approved submittals and manufacturer's instructions and recommendations.

B. Provide field low voltage wiring of VFD system components. Provide field interconnecting wiring between VFD and filters, line reactors and/or by-pass starter if bypass starter is specified and the wiring is not installed at factory. Install wiring in metal conduit and in accordance with Electrical sections of Division 26 and applicable Electrical Code.

C. Provide control wiring between interlocks in VFD control circuits and driven motor's disconnect switches. Interlock VFD control circuits with driven motor's disconnect switches where such motor disconnect switches are provided. Disconnecting on-line motor shall shut down VFD. VFD shall restart upon reconnection of motor.

D. Do not connect ground from one unit to another unit's cabinet.

E. Use separate conduits for incoming and outgoing power conductors from each unit.

F. Use separate conduit for control wiring for each unit. Do not combine control wiring with power wiring.

G. Use minimum 18 ga shielded wiring with ground for control wiring.

H. Install floor mounted drives on concrete housekeeping pad and minimum 3/4" thick 50 durometer, neoprene rubber isolation pad. Install wall-mounted drives on metal framing in accordance with Section 26 0529.

4.4 START UP

A. Assist manufacturer with start-up of VFD in accordance with procedures as defined by manufacturer for proper operation.

B. Adjust critical frequency avoidance feature to step over frequencies which cause excessive vibration in driven equipment.

C. Adjust passive harmonic filter capacitor contactor setpoint to ensure drives do not present leading power factor to electrical systems during low-load conditions.

D. Contractor shall schedule and expedite the manufacturers start-up process and support the Owners commissioning activities. Contractor shall coordinate exact timing of these activities and arrange for appropriate manufacturer personnel to be on-site.

E. After successful completion of equipment installation, the Contractor shall assemble and incorporate equipment shop drawings, operating/maintenance instructions, and part lists into the Contractor's project operation/maintenance manuals.

END OF SECTION

SECTION 23 6510
COOLING TOWERS

PART 1 – GENERAL

1.1 OWNER PRE-PURCHASED EQUIPMENT

A. This equipment will be prepurchased by the Owner and furnished to the successful Contractor after award for expediting delivery, erection by the manufacturer, and installation or constriction of the concrete basin, connecting piping, power and other appurtenances as if the Contractor purchased the equipment directly.

B. Owner will make available manufacturer provided shop drawings of Owner prepurchased equipment for review by the Contractor. Contractor shall review shop drawings to ascertain that Contractor has included necessary labor and materials to install equipment and complete system it serves.

C. Contractor shall be responsible for arranging/coordinating delivery of Owner prepurchased equipment and all other related logistics and activities. This includes directing the delivery trucks to the jobsite, coordinating the date and time of deliveries with other ongoing activities and allocating available laydown space at the jobsite.

D. Due to the limited space on the jobsite, materials will be required to be delivered on an as needed basis. Manufacturer is responsible for unloading of the equipment and related materials at the jobsite.

E. Once the cooling tower is erected by the Manufacturer in the concrete basin that is constructed by the Contractor, the Contractor shall complete the installation process by connecting the cooling towers to the related utility systems. This shall include, but not be limited to; making piping, power, and controls connections, and supporting the start-up, testing, and commissioning of the cooling towers in accordance with manufacturer's recommendations, and maintaining equipment until such time as project is accepted by Owner. Perform all work and provide materials and connections for Owner furnished equipment in accordance with drawings and scope of work under all related specifications.

F. The following summarizes the general responsibilities of the equipment manufacturer:
   1. Provide shop drawings and submittal data.
   2. Procurement, manufacture and delivery of equipment and related cooling tower materials including coordination of exact delivery dates, rigging, unloading, and erection of the cooling towers.
   3. Lead equipment check-out, start-up, and testing process and submit report(s).
   4. Provide O&M documentation.
   5. Provide Owner training and participate in commissioning process.

1.2 SCHEDULE

A. Schedule:

1. The following schedule is anticipated relative to this prepurchased equipment delivery, installation and activation. This is a preliminary schedule and exact dates are to be coordinated with the Owner and Contractor.

a.	Cooling Tower Basin Complete:	October 2025
b.	Tower Materials Delivery and Erection:	October 2025 – February 2026
c.	Installation Work By Contractor:	February – October 2026
d.	Start-Up & Commissioning:	October – November 2026
e.	Vibration and Acoustical Testing ...	November 2026
f.	Thermal Performance Testing	July 2027

1.3 DESCRIPTION

A. The project shall include a three-cell, field erected, cooling tower. Tower cells shall be constructed complete by the manufacturer within a concrete basin with common trough and deep sump provided by the Contractor. Tower shall be provided with access and service provisions as specified herein.

B. The layout on the drawings is based on an induced-draft, counterflow, fiberglass cooling tower. Any variances in capacities, configuration, and operating characteristics than those shown and specified shall be indicated at time of bidding. Bid shall include any additional materials and/or work required to make equipment and installation complete, such as modification to proposed basin, additional structure, piping and electrical upgrades.

C. The tower cells shall be field erected over a partially buried, concrete basin which will also serve as the supporting foundation for the cooling tower. The collection basin is to be provided by the Contractor, though the tower manufacturer shall carefully review the cooling tower support structure design. Tower Manufacturer shall coordinate required modifications with the Contractor or provide any miscellaneous steel or fiberglass penetrations and connections required to connect and anchor the tower to the support structure. All support structure materials shall match those specified for the structure.

D. Cooling tower connection / transition points to the Contractors mechanical piping systems shall be coordinated to avoid field offset piping.

1.4 DEFINITIONS

A. Cooling Tower Manufacturer - Manufacturer of the cooling tower who is responsible for a complete turn-key cooling tower installation as specified herein.

B. Installing Contractor - Contractor who is responsible for the overall coordination of the project and completion of the project scope, including final piping, electrical and controls connections to the cooling tower.

1.5 BID SUBMITTALS

A. The following shall be provided with the equipment bid proposal:

1. Complete Life Cycle Cost Analysis and Acoustical Performance forms included in Part 5 of this section and submit with other bid documentation to allow for evaluation and selection of the best overall value equipment by the Owner.
2. Cover letter with compliance table listing each specification section and indicating compliance “C”, deviation for alternate “D”, or exception with explanation “E”. Any deviation or exception shall be accompanied with detailed explanation of how design intent is being upheld for evaluation by the Owner and Designer.

B. Product data including:
1. CTI data sheet.
2. Dimensioned general arrangement drawings.
3. List of manufactures and cut sheets for major components – structure, casing, fill, drift eliminators, water distribution, sound attenuators, fan stacks, fans, motor, and VFD.
4. Dead and wind loading at each column support.

C. References: a complete list of references shall be provided with each Proposal. The list shall include a minimum of five (5) references where equipment of similar manufacturer type and capacity has been installed. The list shall indicate the name of the facility where the equipment has been installed, location (city and state) of the equipment, installation date, equipment capacity, contact name and contact telephone number of each reference.

D. Scheduled Maintenance Requirements: A complete list of the recommended scheduled maintenance requirements for the equipment shall be provided with each Proposal. The list shall identify each recommended service item and its recommended frequency (monthly, quarterly, etc.). The list shall, at a minimum, include the scheduled maintenance items identified.

E. Other information to verify compliance with the Request for Bids.

F. Award will be based on specification compliance and best overall value for the Owner.

1.6 FABRICATION SUBMITTALS

A. Shop drawings for all items in this Section including, but not limited to, the following:
1. Manufacturer's name and model number.
2. Identification as referenced in the documents.
3. Performance data including certified letter of guarantee from Cooling Tower Manufacturer that the cooling tower being provided for the project will meet or exceed the specified performance criteria at design conditions.
4. Sound ratings for fan and composite cooling tower.
5. Materials of construction.
6. Dimensions and weights.
7. Wiring and interlocking diagrams.
8. Motor data.

9. Complete a CTI data sheet for each cooling tower and submit with shop drawings. Shop drawings will be returned without review if data sheets are not provided and if data sheet is not filled out completely.
10. Cooling tower performance of characteristic curves.
11. Cooling tower nozzle coverage curves.
12. Cooling tower water distribution system layout.
13. Fan performance curves and construction details.
14. Piping layouts, connection and support details.
15. Design loads and calculations for supporting structure including dead load and wind loading at each support column sealed by a professional engineer licensed in the State of North Carolina.
16. Construction and fabrication drawings.
17. Samples of wall panel materials.
18. Complete description of proposed maintenance training program.

1.7 OPERATION AND MAINTENANCE DATA

A. Prior to start-up of the equipment and related Owner Training, submit operations and maintenance manual in accordance with the following.

B. Manual shall include:
1. Manufacturer's name, model number, service manual, spare parts list, and descriptive literature.
2. Names, addresses and contact information for equipment local service representative(s).
3. Copies of final approved Shop Drawings and Product Data Submittals.
4. Instructions for starting and operating the equipment provided.
5. Complete maintenance instructions including preventive maintenance instructions and schedules for equipment.
6. Detailed one-line, color-coded wiring diagrams.
7. Inspection procedures.
8. List of most frequently encountered repairs and trouble-shooting manual(s).
9. Copies of warranties.

C. Manual submission process:
1. Submit a bookmarked digital draft file (.pdf) of the O&M Manual to the Designer for review and comment.
2. Upon acceptance by the Designer submit the final digital file (.pdf) of the O&M Manual along with two (2) hard copies bound in heavy duty 3-ring binders with table of contents and appropriate dividers to the Owner for use/reference during Owner Training sessions.

1.8 SPARE PARTS

A. Furnish one complete set of replacement nozzles for one cooling tower cell to the Owner.

B. Cooling tower fan VFD spare parts as specified in Section 23 0514.

C. At the conclusion training provide a list of additional recommended spare parts for purchase by the Owner.

1.9 WARRANTY

A. The Cooling Tower Manufacturer shall guarantee the complete cooling tower, including the permanent magnet rotor (PMR) motors, will be free from defects in workmanship and materials for a period of five (5) years from the date of project final acceptance. Should any such defects be found and reported during this warranty period, the Manufacturer shall correct such defects by furnishing replacement parts FOB shipping point and all required labor, equipment and materials required to correct the defect.

B. All written warranty claims by the Owner shall be responded to by the manufacturer within 24 hours including a site visit and diagnosis. Prior to leaving the site, a repair schedule shall be mutually established between the Owner and the manufacturer. If the manufacturer fails to meet the repair schedule, the Owner reserves the right to make the necessary repairs. The cost for the Owner to make the repairs shall be invoiced to the manufacturer by the Owner. Through submittal of a bid on this project, the manufacturer is obligated to reimburse the Owner for such repairs (Net 30 days).

PART 2 - PRODUCTS

2.1 COOLING TOWER (FIELD-ERECTED, INDUCED-DRAFT, COUNTERFLOW TYPE)

A. Acceptable Manufacturers:
   1. Composite Cooling Solutions (CCS)
   2. Cooling Tower Depot (CTD)
   3. EvapTech, Inc. (EvapTech)
   4. Marley/SPX Cooling Technologies (SPX)
   5. Tower Engineering, Inc. (TEI)

B. General
   1. Provide field erected induced draft, vertical discharge, fiberglass structure, single-sided air inlet, counterflow type cooling tower as shown.
   2. No plain steel or galvanized steel components will be allowed in the tower.
   3. Tower to be fiberglass-reinforced polyester (FRP) or vinyl resins with PVC fill, with capacity and operating characteristics as specified herein. All fiberglass shall be impregnated with fire retardant and self-extinguishing additives.

4. Tower shall be field erected over a concrete collection basin with pitched bottom. The collection basin is to be provided by the Contractor. Tower shall be designed to meet all requirements of the latest version of the International Building Code and North Carolina Building Code.
5. Work shall include, but is not limited to, providing design services, field erection labor, field supervision, materials, equipment and ancillaries to design, fabricate, deliver, erect, start-up, and performance test the cooling tower as specified herein. Tower manufacturer shall correct all deficiencies at no additional cost to the Owner. Tower shall be field erected by factory trained representatives of the manufacturer.
6. Tower shall be complete and shall include, but not be limited to, frame structure, casings, and partitions, fill material and fill support system, circulating water distribution system, drift eliminators, motors, fan stacks, air inlet attenuators, vibration switches, supports, hardware, bolts, nuts, connectors, anchor bolts, etc.
7. Manufacturer shall be responsible for just-in-time delivery, unloading and storage of materials and equipment at jobsite. There is limited laydown space available at the site and all materials must be stored off-site and brought to the site on a just-in-time basis. The location of space for laydown of tower materials shall be coordinated with all trades. Provide laydown plan to Contractor for review and approval.

C. Performance - ECP:
1. The minimum performance for each cooling tower cell shall be as follows:

a.	Maximum Flow Rate (flow across one cell)	4,200 gpm
b.	Minimum Flow Rate (flow across one cell)	2,100 gpm
c.	Entering Water Temperature	95°F EWT
d.	Leaving Water Temperature	85°F LWT
e.	Ambient Wet Bulb	80°F
f.	Maximum Fan HP	125 HP
g.	Maximum Size per Cell	26’-0” L x 26’-0” W
h.	Cooling Tower Basin Depth	3’-0” Min.
i.	Maximum Fan deck height from top of Basin	32’-0”
j.	Maximum Fan Stack Height	7’-0”
k.	Number of Air Inlets	1 air inlets

2. The full build-out arrangement of the cooling towers shall be a linear arrangement of three cooling tower cells.
3. Drift Loss, other than Evaporation, Maximum Guaranteed Percent of total water flow shall not exceed 0.0005%.
4. Tower performance shall be based on a wind velocity of 0-10 mph.
5. Design and construction of cooling tower cells shall accommodate site conditions which locate the new towers adjacent to existing building. Refer to the dimensions listed above and drawings for further details.
6. The tower cell dimensions shall not exceed the dimensions listed above.

7. All cooling tower materials and methods of construction shall be rated or de-rated as necessary to accommodate a normal over-the-tower water temperature and normal chemical treatment exposure.
8. Tower design wind loading shall be per CTI recommendation or 2018 North Carolina State Building Code, whichever is greater.
9. Tower seismic design shall be in accordance with 2018 North Carolina State Building Code.
10. Fan deck live load (at 100°F) shall be 60 PSF plus the concentrated load of the motor.
11. Maximum pumping head, from the inlet flange connection, including all distribution system pressure drops and nozzle pressure drop shall not exceed the maximum pressure drop in feet of water at the design flow rate scheduled on the drawings.
12. The tower structure and components shall be designed to operate in freezing conditions.

D. Structure:
1. Structural Analysis: Manufacturer shall provide detailed structural calculations for all connections, signed and sealed by a professional engineer registered in the state of North Carolina. Manufacturer shall prove with test data that the connections and design meet the strength characteristics to provide minimum specified service factors as required.
2. Furnish the dead and wind loading at each column support as part of the bid and fabrication submittal data.
3. Unless required otherwise by the Manufacturer, the following minimum service factors shall be used in all structural designs:
    a. Dead Loads
        1) Bearing Service Factor: 4.0
        2) Shear Service Factor: 3.0 minimum
        3) Bending/Flexural Service Factor: 2.5 minimum
        4) Deflection Limits: L/D ratio of 180.
    b. Live Loads
        1) Bearing Service Factor: 2.5 when applied to a fastener group
        2) Shear Service Factor: 2.0 minimum.
        3) Bending/Flexural Service Factor: 2.0 minimum
        4) Deflection Limits: L/D ratio of 180.
4. The minimum service factor for dead loads that shall be allowed for a connection is 4.0. The service factor for connections with temporary loads due to wind, seismic, etc. may be reduced to 2.5. Provide mechanically bolted joints using type 304 stainless steel materials.
5. When connecting hollow type structural members by the use of bolted joint, the service factor for bearing dead loads must be 4.0 minimum and 2.5 minimum for live and dead loads.
6. On bolted joints, stainless washers are required.

7. The field erected FRP composite cooling tower structure shall meet all applicable building codes.
8. Maximum Water Absorption (24-hour immersion) per ASTM D-570 shall be in accordance with CTI STD-137.
9. Tower casing, fan stack, fan deck, beams, lintels, seismic bracing, columns, supports and partition walls shall be constructed of corrosion resistant, fire-retardant, self-extinguishing, manufacturers standard color (selected by Designer) fiberglass reinforced polyester or vinyl resin and contain an ultraviolet ray inhibitor as per CTI Standard-137.
10. The cooling tower FRP structure walls, roof deck, support beams and columns shall be fabricated from composite continuous fiberglass pultruded sections specifically designed for cooling tower application.
    a. The exterior wall sections for double wall construction units and shall weigh not less than 32 ounces per square foot.
    b. The exterior wall section for single wall construction units shall weigh not less than 14 ounces per square foot.
11. The exterior casing panels shall be extended up to 42 inches above the fan deck and be trimmed out to serve as a handrail around the deck and shall match the tower casing in finish and color. Provide access openings in the casing extension as required for deck access as specified herein.
12. The exterior casing panels shall be extended up to the height of the fan deck. All end walls and sidewalls shall be extended down to the top of the concrete basin walls or column support piers to minimize the airflow and water flow between cells. The area between the perimeter sidewalls and the concrete basin shall be covered with FRP casing or stainless steel flashing material equal to that used on the tower. Pitch the material to the wall with a 1/8” per 1’-0” slope.
13. Seal all joints in the outer casing and interior partition walls to be watertight at the time of erection. Any leakage shall be repaired by the manufacturer.
14. Provide wind walls, deflector plates and baffles in interior of cooling tower to eliminate water spill out and mist carryover.
15. Pultruded FRP box beams and wide flange I-beams shall be used for fan deck support.
16. All of the exterior and interior surfaces of the fiberglass structural members and components shall be protected from Ultraviolet (UV) rays as well as water migration by gel coat or polyester surfacing veils molded internally into the composite part. On pultruded members the UV protectors and color pigments shall be formulated in the resin matrix.
17. Each tower shall be supported by a limited number of support columns. Where cells are adjacently located, the towers shall share columns for structural support. Refer to the drawings for the general tower/cell basin layout.
18. All support columns shall rest on concrete piers on the concrete collection basin floor. The top of the concrete piers shall be level and located approximately 1’-0” below the top of the basin wall.

19. Provisions shall be made on the exterior and interior of the tower structure to accommodate supporting / bracing piping risers and conduits that serve the tower with power, lighting, lightning protection, and controls. Manufacturer to coordinate exact connection requirements and details with the Contractor.
20. A minimum 2'-6" access aisle is required around the fan deck. If required due to fan stack dimension, provide cantilevered catwalk around perimeter of cooling tower to provide required access aisle.

E. Fill Support System
1. Structural Analysis: The vendor shall provide detailed structural calculations for all connections, signed and sealed by a professional engineer registered in the state of North Carolina. The vendor shall prove with test data that the connections and design meet the strength characteristics to provide minimum specified service factors as required.
2. The fill pack shall be bottom supported by pultruded FRP support lintels or heavy duty type 304 stainless steel lintels. Lintels shall be designed to support the fill and include a design safety factor of 3.0.
3. Structural Performance: Supports shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
    a. Fill Support Dead Load: Dry weight of fill material plus water hold up weight plus 15% additional allowance for fill clogging.
    b. Fill support Live Loads: 300 lbs. of concentrated load for temporary maintenance foot traffic.
    c. Fill supports shall be capable of supporting all loads expected when the tower is operating, including ice loading.

F. Fill
1. The fill shall be wave-formed sheets, cross-corrugated film type, high grade polyvinyl chloride (PVC), conforming to ASTM D-1784, type 1, grade 1 with a flame spread rating of 25 or less per ASTM E-84.
2. The fill material shall be of minimum 15 mil thickness after forming and shall be adequately supported to provide the necessary rigidity to be free from sagging and channeling of water.
3. The design of the fill system shall be such to provide freedom to expand and contract without over stressing.
4. The fill material must be easily replaceable. The fill material shall be suitable for continuous water temperatures to 120°F.
5. Each successive layer of fill packs should be installed at right angles to the lower layer to ensure proper water dispersal.
6. The fill PVC material shall have additives to prevent damage to the fill from ultraviolet radiation.

G. Drift Eliminator Support System
   1. Structural Analysis: The vendor shall provide detailed structural calculations for all connections, signed and sealed by a professional engineer registered in the state of North Carolina. The vendor shall prove with test data that the connections and design meet the strength characteristics to provide minimum specified service factors as required.
   2. The drift eliminators shall be supported by a separate support system connected to the tower structure and shall not be supported by the distribution piping or from the fill pack.
   3. The drift eliminators shall be bottom supported by pultruded FRP support lintels or heavy duty type 304 stainless steel lintels. Lintels shall be designed to support the fill and include a design safety factor of 3.0.
   4. Structural Performance: Supports shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
      a. Fill Support Dead Load: Dry weight of fill material plus water hold up weight plus 15% additional allowance for fill clogging.
      b. Fill supports shall be capable of supporting all loads expected when the tower is operating.

H. Drift Eliminators:
   1. Drift Eliminators shall be designed and arranged to limit the drift loss to a guaranteed performance value of 0.0005% of circulating water flow.
   2. The drift eliminators shall be constructed of PVC with similar physical properties to those of the cooling tower fill material, but have additional ultraviolet light inhibitor. The drift eliminators shall be a proven design.
   3. The drift eliminators shall be designed to allow trapped water to drain into the fill area.
   4. The drift eliminators shall be designed so they nest or interlock with the module next to them, eliminating interfaces between modules, conforming to ASTM D-1784, Type 1, Grade 1, with a flame spread rating of 15 or less per ASTM E-84.
   5. Drift eliminators shall utilize 0.020” stiffener sheets after forming.
   6. The eliminators shall be installed with air seals around the tower structure to properly direct the flow of air through the panels and to prevent edge wear due to handling of eliminators.

I. Inlet Sound Attenuators
   1. Manufacturers: Industrial Acoustics Company, Semco, Aerosonics, United McGill, Aeroacoustic, Commercial Acoustics, Vibro-Acoustics, VAW Systems, Price Industries, or Rink Corporation. Basis of Design: Vibro-Acoustics Model RNM-LV-F7-36.
      a. Submit independently certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance.

b. Outer casing of units shall be not less than 22 ga 304 stainless steel in accordance with recommendations in the latest edition of ASHRAE Guide and Data Book for high pressure rectangular ductwork for 4" WG pressure class. Seams shall be lock formed or continuously welded and mastic filled. Units shall be packless and lined with not less than 26 gauge perforated 304 stainless steel.

c. Ends of attenuators shall be covered at factory with plastic to prevent entrance of dirt, water, or any other foreign matter to inside of attenuators. Caps shall not be removed until attenuator is installed.

d. Unless otherwise indicated, sound attenuating devices shall be 3 feet long and shall meet acoustical performance requirements as follows for each octave band frequency at -1000 silencer face velocity flow conditions.

Octave Band								
	63	125	250	500	1000	2000	4000	8000
DIL (dB)	8	8	13	19	14	12	11	10

J. Hardware:

1. All bolts, anchor bolts, nuts, washers, hangers, connectors and other similar hardware shall be stainless steel. All bolts shall be full body design in accordance with CTI Standard STD-119.
2. Self-tapping screws are prohibited for structural connections.
3. Cooling tower manufacturer to provide a detailed drawing of the concrete basin anchor bolt locations and furnish/install the anchor bolts at the time of the cooling tower installation. Anchor bolts shall be drilled and epoxied in place by Manufacturer.

K. Water Distribution System:

1. Distribution system for each cell shall have an external Class 150 ANSI flange connection complete with header, side laterals, fittings, and nozzles supplied by tower manufacturer. The face of the flange shall be located 12” beyond the exterior face of the tower casing. All distribution system piping shall be either PVC or fiberglass. Fittings and nozzles shall be FRP, PVC, or polypropylene. Connection flange shall be located as indicated on drawings and shall be on the side of the tower. No center risers will be allowed.
2. Side laterals shall connect to header with a flange, PVC welded or clamp-on saddle. All saddle hardware shall be stainless steel and saddle gaskets shall be EPDM.
3. The distribution system for each cell shall be capable of uniformly distributing the supply water over the entire cross-sectional area of the tower fill material at +10% to -50% of design flow conditions.
4. The distribution system shall be arranged to allow complete automatic drainage of distribution piping when the tower is shutdown.
5. The distribution system shall be designed to prevent clogging of distribution nozzles with silt or other debris. A clean-out provision shall be located at the terminal end of each lateral and each header to provide a convenient means of inspection and removing silt accumulations.

6. The nozzles shall be large orifice design, to prevent clogging. Each nozzle shall be easily removable without the use of special tools for cleaning and replacement. Up spray nozzles shall not be allowed.
7. Nozzles shall connect to side laterals with a clamp-on saddle with stainless steel nozzle thread reinforcing. All saddle hardware shall be stainless steel and saddle gaskets shall be EPDM.
8. Provide a pressure vs. nozzle flow curve with the shop drawing submittal.
9. The distribution piping system shall be supported from the tower structure (beams or columns) with stainless steel hangers and supports and attachments. The use of bent rods, plastic zip ties and other strapping materials for hangers and supports shall not be allowed.

L. Fan Stacks:
1. Fan stacks (cylinders) shall be constructed of manufacturers standard color (selected by Designer) fiberglass reinforced polyester with stiffening ribs and shall be of the same quality resin and glass as specified for the tower structure. The fan stacks shall be venturi shaped. Interior and exterior surfaces shall be protected from ultraviolet radiation and water migration.
2. Provide sealant between fan stack sections and fan deck to eliminate bypass airflow.
3. Provide a removable hatch (minimum size 3’-0” x 6’-0”) in each fan. Hatch shall be gasketed and provided with a series of 90 degree turn handle latches or similar permanent devices for securing hatch in place during operation.
4. Provide one heavy duty clear plastic observation port in the fan stack to allow for visual inspection of the fan assembly while in operation. Port shall be a minimum of 4 inches in diameter.
5. Provide EPDM grommets to seal all penetrations (conduits, piping, etc.) of fan stack.

M. Fan Assemblies
1. Fans shall be ultra low noise type.
2. Each fan blade shall be of adjustable pitch individually clamped in a common hub. The entire fan assembly shall be statically and dynamically balanced and tested in the field.
3. The fan blades shall be fabricated from a fiberglass-reinforced system with a protective stainless steel leading edge.
4. Hubs and associated bolts shall be 304 stainless steel and shall be furnished with hub covers.
5. The complete fan assembly (fan and mounting) shall be designed to give maximum fan efficiency and long life when handling saturated air at high velocities.
6. Provide the required blade pitch installation data at the time of start-up and adjust as required during commissioning and thermal, vibration and acoustical testing to achieve design performance.
7. Fan blades shall be interchangeable with no balancing required. Weights are not allowed on fan blades for balancing purposes.

N. Vibration Safety Switch

1. Two (SPDT) safety switches with reset shall be supplied for each motor. The switches shall be designed for outdoor use and shall be mounted, accessible from the service platform inside the cooling tower fan stack. Install one switch on two adjacent sides of the fan motor. Any excessive vibration of motor and assembly shall automatically cut off the driver. Switches shall be supplied with a manual reset on face of switch. Each switch shall be installed by cooling tower manufacturer and wired by the Contractor with one contact to the tower VFD and the second contact to the plant control system.

O. Electric Motors and Variable Frequency Drives:

1. Manufacturer shall furnish the electric motors and companion VFDs for each cooling tower fan. Manufacturer will install the fan motors on the tower and deliver the VFDs to the Contractor for installation. Contractor shall set VFDs and provide all power and control wiring required for operation of the cooling tower motor and VFD as coordinated with the Manufacturer.
2. The motors are to be premium efficiency synchronous permanent magnet rotor (PMR) type using high flux strength Neodymium iron Boron (NdFeB) magnets. Motors shall be located inside of the cooling tower air stream and shall be designed for outdoor use, totally enclosed air over (TEAO) enclosures with a 1.0 service factor at 40°C ambient and VPI Class H insulation for severe high humidity application. The motor torque rating (horsepower and base speed) shall be specific to the fan load requirements.
3. Motors shall comply with NEMA MG 1 part 31 standards for definite-purpose inverter-fed motors and shall be 3 phase, 460V construction. The motor shall utilize low profile finned laminate frame construction for direct, vertical shaft up mounting to the cooling tower fan assembly. The opposite motor end shall be flange bolted to a stainless steel base plate which is through-bolted securely to the cooling tower structure.
4. Cooling tower motors shall have two internal thermostats in the stator windings with normally closed contacts. One contact shall open if temperature rises above (overtemperature) setpoint and the other shall open when below (low temperature) setpoint determined by motor manufacturer. This shall be via digital input arranged to coordinate with normally closed contacts for motor thermostats. Outdoor motors shall also be provided with 120V heating elements to eliminate moisture in motor when fan is not being operated during and low temperature conditions. Thermostats shall be monitored and heaters activated by associated VFD controller. Heater power shall be provided and extended separately through the VFD.
5. VFDs for direct-drive fan motors shall be furnished by cooling tower manufacturer and installed by the Contractor. Refer to Specification Section 23 0514 Process Variable Frequency Drive (VFD) System. VFD shall have capability to operate motor in forward or reverse rotation. VFD shall receive forward and reverse signal from the plant control system.
6. The cooling tower manufacturer shall furnish data on critical speeds to be locked out by the VFD system. The minimum fan speed shall be above the lock-out frequencies of the fan/VFD system.

P. Access Provisions:

1. The towers shall be furnished with the following access provisions for proper operation, inspection and maintenance. All access related provisions shall comply with OSHA requirements and shall be generally located as shown on the drawings unless approved otherwise by the Designer.

   a. One stairway on exterior of the tower casing from grade level to fan deck. Stairway to be constructed of manufacturer standard color (selected by Designer) fiberglass to match the cooling tower structure and be independently supported, but may be braced to the tower structure if required. It shall originate at grade and continue with intermediate landings as required to provide access to the top of the basin sump and fan deck. Provide 36" wide (min.) connector bridge from stair landings to top of basin sump and fan deck as necessary. Provide stairs and connector bridge with 3'-6" tall handrails. All stairs and landings shall be designed for a live load of 100 PSF plus other code required loads.

   b. Provide one (1) fiberglass ladder with fall protection system including standoff platforms and safety gate at fan deck level on exterior of the tower from grade level to cooling tower fan deck. Ladder shall be painted to match the color selected for the cooling tower casing and structure.

   c. Top perimeter of fan deck shall be provided with a 42" high handrail that is an extension of the tower casing and shall be trimmed out to match the tower casing in finish and color.

   d. Provide one 3'-0" x 7'-0" hinged and latched door with door handle and retainer chain in exterior wall of each cell (3) and in each interior partition wall between cells (2). Door and frame materials shall match those provided for the walls. Provide flashing, deflectors and sealant around the doors to prevent leakage. Access doors to be provided with internal ladders and service platforms with handrails to allow for access to and between the separate sections of the basin. Materials and hardware shall match those used for the cooling tower. Platform and ladders shall be anchored to the basin and the tower structure.

   e. One fiberglass access hatch (minimum size 2'-6"x2'-6") and ladder per cell shall be provided on the fan deck and at the drift eliminator level of the tower complete with compatible frame and gasketed door to provide access to the tower interior below the fan deck and the drift eliminator level and to the fill and distribution system. Hatch in fan deck shall be hinged and hatch in drift eliminator level shall be a framed removable section of drift eliminators. All hatch door and ladder hardware shall be be stainless steel. Hatch access location shall be coordinated with and not be impeded by internal distribution piping.

   f. Inside the fan stack perimeter provide a continuous fiberglass non-slip service platform at the fan deck elevation. Platform shall be supported from cooling tower structure with stainless steel hardware and shall not rest on the drift eliminators.

Q. Jib Crane:
   1. Provide 1/4 ton manual jib crane on the fan deck of the cooling tower capable of lifting tools and equipment from the ground to the fan deck.
   2. Jib crane surfaces shall be 2-part epoxy coated. No bare steel is allowed.
   3. Locate jib crane as shown on the drawings.

R. Acoustical Performance:
   1. Refer to requirements in Part 5 of this section.

PART 3 – EXECUTION – BY EQUIPMENT MANUFACTURER

3.1 COOLING TOWER INSTALLATION

A. General:
   1. Manufacturer is completely responsible for field erecting the cooling tower including all assembly, rigging and performance testing as specified herein.
   2. Prior to the start of field erection, the Cooling Tower Manufacturer shall visit the site and verify the site is ready for tower installation.
   3. Manufacturer shall provide all tools, hoist, rigging equipment, and test instrumentation to make the tower operational.
   4. Manufacturer shall coordinate and cooperate with the Contractor related to the construction of the concrete basin and access/use of the jobsite so as to not impede the Contractor's construction activities.
   5. Manufacturer shall coordinate requirements for taps in piping system required for measuring flow, temperature, pressure, etc. associated with thermal performance testing.

B. Workmanship and Materials:
   1. All materials used in the tower shall be manufactured for the tower specified. The use of parts which contain bolt holes, cuts, etc. that are not specifically for the specified tower shall not be allowed.
   2. All equipment, materials, etc., required by these specifications shall be in compliance with the Federal Occupational Safety and Health Act.

C. Erection:
   1. All materials specified herein and furnished by the manufacturer shall be erected in place by the manufacturer.
   2. Cooling tower fan VFDs shall be furnished to the Contractor to install.
   3. Manufacturer shall furnish a competent and experienced crew, and superintendent to supervise the work. Manufacturers crew shall cooperate at all times with the Owner and Designer representatives and all other Contractors.
   4. Delivery, unloading and storage of materials and equipment, including any weather protection required, shall be done by the manufacturer.
   5. Manufacturer shall provide scaffolding, all erection hoists, jacks, lifting lugs, tools, and equipment required for proper execution of the work. Remove all such temporary measures prior to completion of erection process.

6. Air inlet sound attenuators shall be provided on the towers. Attenuators shall be supported from the basin walls and shall be attached to the tower framing/casing to prohibit any bypass air and escaping sound. Air inlet area and fan horsepower shall account for installation of specified sound attenuators. Manufacturer to coordinate exact elevations and details of the support structure with the Contractor.
7. Any stainless steel members that may require welding shall be passivated to restore chromium oxide layer.

3.2 START UP

A. Manufacturer shall provide for services of factory trained service engineer to supervise and approve installation and perform cooling tower start-up and testing prior to beginning of field testing.
   1. Provide information and assistance as required, during start-up.
   2. Cooperate and coordinate with Owner and Contractor.
   3. Provide all inspection, test, adjustment, and balancing services including but not limited to, inspection of all critical tolerances, proper fan/motor operation, VFD programming, and proper safety device operation.
   4. Start-up services shall be an addition to performance testing, training, and commissioning requirements.
   5. Submit inspection start-up and checklist log showing all initial settings and readings; signed by manufacturer's service representative.

B. Manufacturer shall provide the Contractor and Designer twenty days written notice of the commencement of start-up procedures, a list of deficiencies and corrective steps, which need to be completed by others.

C. Include appropriate Owner’s personnel during start-up procedures. Demonstrate methods of starting up equipment and normal operating techniques. Coordinate start-up date with Owner and Designer. Provide a minimum notice of 10 days prior to anticipated start-up.

D. Inspect, adjust, clean, service, calibrate and repair any and all elements of the cooling tower prior to start-up. Provide all tools, ladders, etc. as required in starting all equipment and clean-up of debris.

E. Prior to acceptance by Owner, unit manufacturer shall approve, in writing, the complete installation, including piping and wiring connections, and proper functioning of all operational and safety controls.

3.3 FIELD PERFORMANCE TESTS

A. General:
   1. Manufacturer shall acquire the services of independent third-party testing agency or agencies to conduct the performance tests specified herein. Qualifications for each testing agency shall be submitted prior to commencement of testing to the Owner/Designer for review and approval. Each testing agency shall have conducted similar testing on at least five cooling towers of similar construction in last five years.

2. All field performance tests shall be conducted in the presence of the Owner/Designer representatives. Manufacturer shall notify Owner/Designer of the desire to test a minimum of two weeks prior to any proposed date. Owner/Designer shall review and approve the desired date prior to commencement of testing. Approval to test may be withheld due to the operational status of the plant due to incomplete construction of required systems of controls, Owner maintenance, cold weather conditions which prohibit water flow over the tower, or availability of staff to witness test or operate equipment for testing. If unable to approve desired test date, Owner and Designer shall respond with an appropriate time frame as to when testing can be completed.
3. Within two weeks of completion of testing, the testing agency shall submit a complete bound report including all readings, a summary of findings and recommendations. Report shall be reviewed and approved by Owner/Designer and if found unacceptable, additional readings, adjustments, repairs, testing, and resubmission of the report may be required.
4. In the case of the tower failing to meet specified requirements, the manufacturer shall promptly make the necessary corrections. Such corrections, as may be required, and the expense of re-testing to verify improvements, shall be made at no cost to the Owner.
5. If larger size motors and VFD's are required the manufacturer shall also pay for all materials and installation of all electrical components to accommodate the increased size.

B. Vibration Testing:
1. Thermal performance tests shall be conducted to demonstrate the performance of each cell with design water flow and air flow.
2. Testing shall be completed utilizing a vibration analyzer which is NIST certified and calibrated.
3. The fan motor bearings vibration testing shall be in accordance with the CTI manual, Chapter 10. Additionally, other testing shall be performed on both the fan stack and the fan deck/structure as noted below. All readings shall be equal to or less than the values indicated below. Note that all values are "filtered" type, unless noted otherwise.

Location	Fan Speed	Motor Speed	Blade Pass Frequency	"Unfiltered" Value
Fan Motor Bearings	0.07in/sec.	0.15 in/sec.	--	--
Fan Stack	--	--	2.0 in/sec.	--
Structure/Deck	--	--	--	15 mils

a. Fan bearing readings shall be taken in the horizontal, vertical and axial directions.
b. Fan stack readings shall be taken in four locations, at 90 degree intervals, at the midpoint of the stack and shall be taken in the horizontal direction.

c. Fan deck readings shall be taken in the vertical and axial directions, at a minimum of four (one per side) locations to be selected by the Owner/Designer.

C. Thermal Performance Test:

1. Thermal performance tests shall be conducted to demonstrate the performance of each cell.
2. The performance tests shall be conducted in accordance with the most current version of Cooling Tower Institute Test ATC-105 and associated tolerances. All instrumentation for testing shall be provided by the testing agency.
3. The field assembled cooling tower shall be field tested to confirm the ability to meet the 100% load condition. Note that the timing of this test is weather dependent to ensure that adequate load is available and to reduce the need to apply correction factors to the measure test data due to lower ambient air temperatures. Weather and load conditions are typically appropriate for the test between mid-June and mid-September. Based on the anticipated project schedule, it is expected that a separate site visit by the tower manufacturer to properly test the tower after the contract completion date. A sum of $50,000 will be retained to cover the cost of these tests and potential tower enhancements. These funds will only be released upon successful completion of the tests and approval of the test reports by the Owner/Designer. At conclusion of the field test, guarantee to Owner that cooling tower meets the 100% load condition.

D. Acoustical Performance Test:

1. Acoustical performance tests shall be conducted to demonstrate the performance of the new cooling tower and verify compliance with the Town of Chapel Hill Noise Ordinance. The nearest property line is near residences at 1400 Mason Farm Road designated as receptor R11 and 1500/1502 Mason Farm Road designated as receptor R10 in the following aerial image with green thumbtacks.

2. The following table below specifies the GPS and UTM coordinates for receptors R10 and R11.

Address:	1400 Mason Farm Road	1500/1502 Mason Farm Road
Receptor ID:	R11	R10
GPS Latitude:	35.897702°	35.897595°
GPS Longitudinal:	-79.045328°	-79.043159°
UTM Easting, Zone 17 S:	676408.00 m E	676604.00 m E
UTM Northing, Zone 17 S:	3974367.00 m N	3974359.00 m N

3. Overall Sound Pressure Level Requirement: Not to exceed an overall A-weighted of 45 dBA when all three cells are operating at 100% design water flow and fan speed.
4. Low frequency noise level requirement: In 1/3 octave frequency bands to have Unweighted 3rd octave band SPL to be less than or equal to values in table below.

One-Third Octave-Band Center Frequency, Hertz	One-Third Octave-Band SPL, dBL
	Residential Nighttime
16	78
20	70
25	62
31.5	55
40	52
50	51
63	50
80	49
100	48
125	47
160	46
200	45
250	44
315	42
400	40
500	38
630	36

5. Manufacturer will be required to provide 3rd party field testing using a Type 1 sound level meter calibrated within the last 12 months verifying conformance with the above ordinance limits (background noise corrections to measurement data is permitted as long as background noise is steady and at least 2 dB lower than the measurement level to be corrected in the particular band or overall level) at receptor R10 and R11 locations. Measurements should be made when background noise does not interfere with demonstrating compliance.

3.4 OWNER TRAINING

A. The equipment manufacturer shall provide full operating, service and maintenance training programs for the Owner's maintenance personnel. All costs associated with Owner Training shall be included in the base proposal, including travel and per diem expenses. Training shall occur at the Owners facility.

B. Instruction time periods shall be approved by the Owner and conducted during normal working hours of 8:00 AM to 3:00 PM Monday through Friday. Instruction shall be a combination of classroom instruction and hands-on training.

C. The training course shall focus on equipment fundamentals and operation and shall include:
   1. Start-up, check-out and routine inspections and maintenance.
   2. Electrical and controls sequencing and trouble shooting.
   3. Nozzle removal and replacement.
   4. Motor servicing.
   5. VFD operation and maintenance in accordance with Section 23 0514.

D. The training course shall include a minimum of up to 16 hours of training time. The course shall be conducted at the University for up to ten (10) personnel.

E. A complete syllabus and O&M Manuals shall be submitted and approved by Owner four weeks prior to training.

F. At the end of each training course, the manufacturer shall provide to the Owner complete service manuals and bulletins that would be equal to the manuals that would be provided to the manufacturer’s own service technicians. The manufacturer shall include the Owner on their update mailing list to make available for purchase by the Owner, all updates to the service manuals and new service bulletins that are issued after the completion of the training program.

G. Owner may video tape training sessions for their use in future training of their operations and maintenance staff.

3.5 COMMISSIONING

A. Upon construction completion, the chiller plant and associated equipment will be commissioned by the Owner. Manufacturer will be responsible for providing a factory trained technician on site for a minimum of 40 hours during this commissioning process. This time shall be in addition to any other start-up, training, etc. Scheduling of commissioning will be by the Owner.

B. The field performance tests specified herein shall be completed after successful commissioning. The 40 hours above does not include the time for that testing and will require a separate trip.

PART 4 – EXECUTION – BY INSTALLING CONTRACTOR

A. The Contractor will perform the following work associated with the new cooling towers:
   1. Provide new concrete basin and associated appurtenances shown on the drawings.
   2. Rigging and setting of VFDs furnished by the cooling tower supplier.
   3. Extend condenser water and other auxiliary water piping to the cooling towers.
   4. Piping connections to cooling towers shall not create stress on connection point. After final connections are completed, Contractor shall remove bolts from flanged connections at cooling towers. Piping shall remain aligned with cooling tower connections after bolts have been removed. If piping becomes misaligned after bolts have been removed, or if bolts cannot be removed by hand, Contractor shall revise piping to align piping with cooling tower connection. Piping/cooling tower alignment verification shall be completed in the presence of the Owner's representative. If after completion of the strain-free verification the piping system must be disassembled at any point in the system, the strain-free verification shall be repeated.
   5. Install control devices, raceway systems and/or wiring between the cooling towers and VFD's and the plant control system.
   6. Extend electrical service to the cooling towers including feeders to the VFD's, motors and associated auxiliary devices including but limited to convenience power, lighting, and lightning protection.
   7. Provide all taps in piping systems required for measuring flow, temperature, pressure, etc. associated with Manufacturers thermal performance testing.

B. Secure any installation permits required by the State and local authorities and complete these requirements before system is placed in operation.

C. Contractor shall schedule and expedite the manufacturers start-up process and support the Owners commissioning activities. Contractor shall coordinate exact timing of these activities and arrange for appropriate manufacturer personnel to be on-site.

D. After successful completion of equipment installation, the Contractor shall assemble and incorporate equipment shop drawings, operating/maintenance instructions, and part lists into the Contractor's project operation/maintenance manuals.

PART 5 – PERFORMANCE

5.1 LIFE CYCLE COST ANALYSIS FORM

A. Complete and submit the following form **with Bid** submittal.

Cooling tower selection data is as follows.

Cooling Tower Technical Requirements	Design Conditions - Per Cell
Nominal Capacity (Tons)	1,400
Flow (gpm)	4,200
Maximum Pressure Drop From Inlet Flange (ft)	25
Entering Water Temperature (deg F)	95
Leaving Water Temperature (deg F)	85
Outdoor Air Wet Bulb Temperature (deg F)	80
Fan Electrical (Max Hp/V/Ph/Hz)	125HP / 480V / 3Ph / 60Hz, VFD

Cooling load profile that will be utilized to evaluate the cooling tower(s) proposed by the manufacturers at bid time is as follows.

Expected Cooling Tower Utilization Profile - Per Cell					
Water Flow (GPM)	Fan Speed (%)	Hours Per Year	Entering Water Temp. (°F)	Leaving Water Temp. (°F)	Outdoor Air Wet Bulb Temp. (°F)
4,200	100	500	95	85	80
4,200	100	2,000	85	78.5	70
4,200	100	1,500	75	71.5	60
2,100	100	1,000	65	55	50

Manufacturer shall input the operating data (kW and LWT) for the proposed cooling tower, in the following table.

Manufacturer Data – Proposed Cooling Tower Performance - Per Cell					
Water Flow (GPM)	Fan Speed (%)	Power Input (kW)	Entering Water Temp. (°F)	Leaving Water Temp. (°F)	Outdoor Air Wet Bulb Temp. (°F)
4,200	100		95		80
4,200	100		85		70
4,200	100		75		60
2,100	100		65		50

The life cycle cost shall be computed as follows:

1. Life Cycle Cost = Purchase Cost + (first year operating cost x economic life in years).
2. Electricity Cost Calculated Based on $0.08 / kWh.

5.2 ACOUSTICAL PERFORMANCE FORM

A. Complete and submit the following form **with Bid** submittal.

B. Single cell inlet tower sound pressure levels (SPL) including water and fan noise with 3 foot inlet sound attenuators installed.

Sound pressure level (SPL) for one cell operating at full design capacity shall not exceed the allowable limits in the following table at a distance of 50 feet from the center of the tower cell inlet 5 feet above the bottom of the inlet on hard reflective ground. The Cooling Tower shall be designed to limit noise generation through lower fan tip speeds, ultra low sound fans, inlet sound attenuators, fan deck barrier walls, oversizing, and other techniques rather than the use of fan outlet sound attenuators, water fall area or cold water basin treatments that will not be allowed.

Octave Band SPL @ 50 feet (dBL)					(dBA)
Frequency	63	125	250	500	OA SPL
Specified Sound Pressure Levels	49.0	52.0	50.0	45.0	61.0
Sound Pressure Levels Input from Manufacturer					

1. Octave band SPL are un-weighted (dBL), overall SPL is A-weighted (dBA).
2. Manufacturer shall indicate/input expected noise levels (from measurements or calculations) in table above and provide supporting documentation (such as calculation sheets or measurement reports).

C. Single cell fan outlet sound power levels (SWL) with 3 foot inlet sound attenuators installed.

Sound power level (SWL) for one cell operating at design airflow conditions shall not exceed the allowable limits in the following table.

Octave Band SWL (dBL)					(dBA)
Frequency	63	125	250	500	OA SWL
Sound Pressure Levels	92	97	94	92	93
Sound Pressure Levels Input from Manufacturer					

1. Octave band SPL are un-weighted (dBL), overall SPL is A-weighted (dBA).
2. Manufacturer shall indicate/input expected noise levels (from measurements or calculations) in table above and provide supporting documentation (such as calculation sheets of measurement reports).

END OF SECTION

Affiliated Engineers

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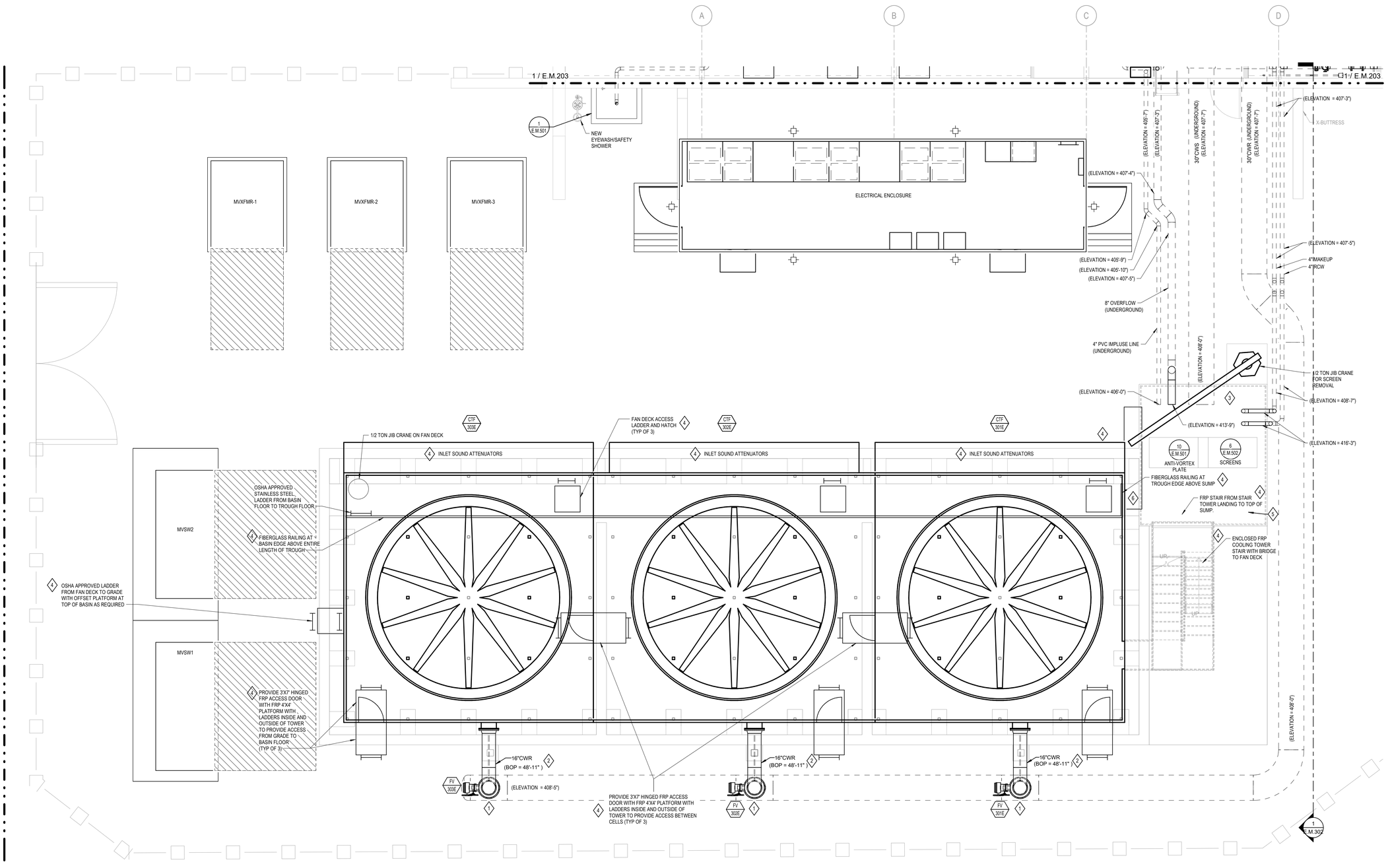
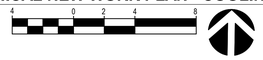
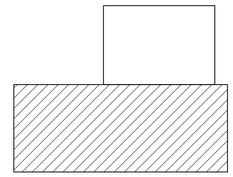


1 MECHANICAL NEW WORK PLAN - COOLING TOWER YARD

SCALE: 1/4" = 1'-0"





KEYPLAN

12/06/24

Sheet Keynotes:

1. COOLING TOWER MANUFACTURER TO PROVIDE LATERAL BRACING ATTACHED TO NEW CWR PIPE RISERS.
2. ALL ELEVATIONS ARE SHOWN WITH REFERENCE TO FIRST FLOOR MECHANICAL FFE.
3. ALL SLEEVES FOR PIPING CONNECTIONS TO COOLING TOWER BASIN AND SUMP SHALL BE STAINLESS STEEL.
4. ITEM TO BE PROVIDED BY COOLING TOWER MANUFACTURER.
5. COOLING TOWER LEVEL CONTROL INSTRUMENTATION SHOULD BE MOUNTED HERE PER DETIL 8/E.M.502.
6. INSTALL LADDER BETWEEN TOWER TROUGH AND TOWER SUMP IN ACCORDANCE WITH DETAIL 1/E.M.503.
7. TERMINATE 4" RECLAIM AND 4" MAKEUP PIPING 1'-0" ABOVE TOP OF OVERFLOW PIPE OR 4" BELOW CEILING LEVEL INSIDE SUMP.

Rev	Date	Description of Issue
B	10/18/24	CD FOR REVIEW
A	05/24/24	SD / DD

Project

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

Chilled Water Infrastructure Expansion

SCO# 22-25588-02B
CODE: 42123-355 / 42323-305
UNC BLDG. NO 505

Sheet Title

MECHANICAL NEW WORK PLAN - COOLING TOWER YARD

Scale

1/4" = 1'-0"

Date	Drawn By
10/18/24	DVS

Project No.	Checked By
23480-02	BJP

Sheet No.

E.M.204

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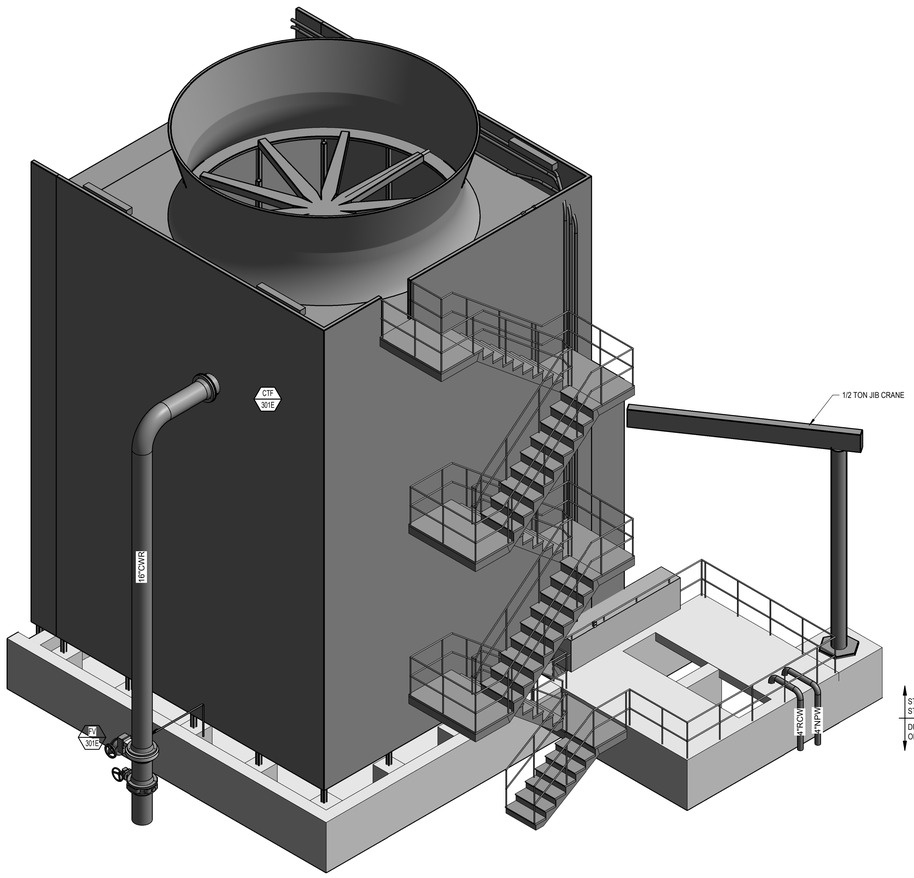
NORTH CAROLINA PROFESSIONAL SEAL 031487 ENGINEER NITHAN D. CESAR

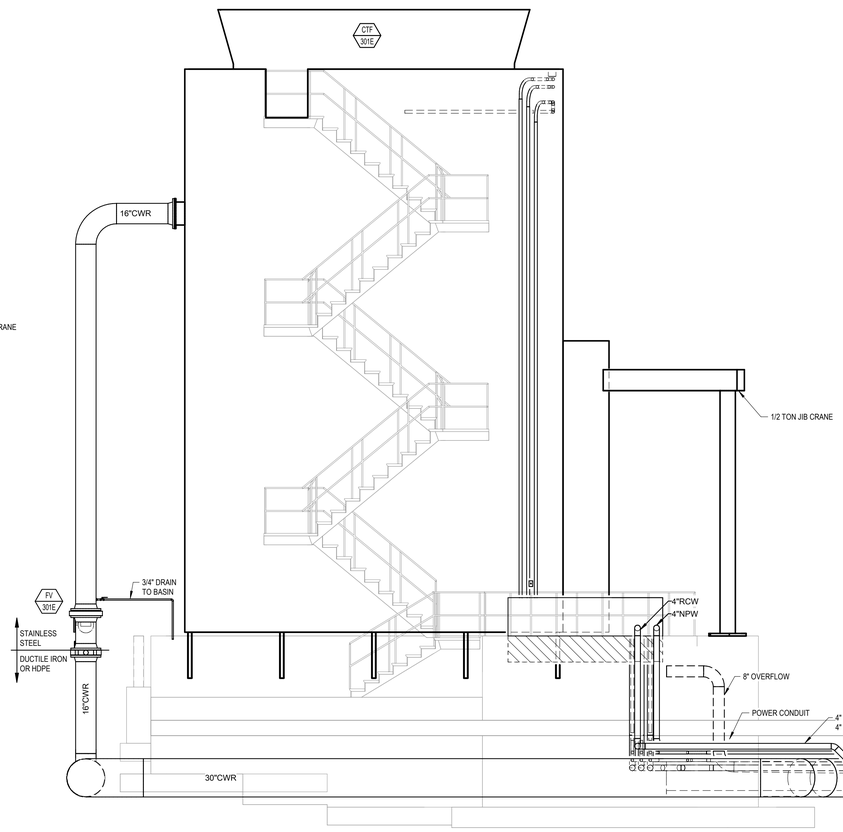
12/06/24

Sheet Keynotes:



2 COOLING TOWER LOOKING NORTHWEST

SCALE:



1 COOLING TOWER YARD LOOKING WEST

SCALE: 1/4" = 1'-0"

4 0 2 4 8

Rev	Date	Description of Issue
B	10/18/24	CD FOR REVIEW
A	05/24/24	SD / DD

Project

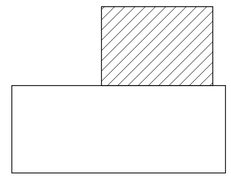
THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

Chilled Water Infrastructure Expansion

SCO# 22-25588-02B
CODE: 42123-355 / 42323-305
UNC BLDG. NO 505

Sheet Title

MECHANICAL SECTIONS



KEYPLAN

Scale

1/4" = 1'-0"

Date	Drawn By
10/18/24	DVS

Project No.	Checked By
23480-02	BJP

Sheet No.

E.M.302

10/24/2024 10:01:37 AM Autodesk Docs://23480-00 UNC CHW Infrastructure Expansion/23480-02_ECP_MEP.rvt

CHILLERS

23 6000

MARK (CRM)	LOCATION	TYPE	CAPACITY (TONS)	MAXIMUM KW/TON	EVAPORATOR GPM	EVAPORATOR EWT (°F)	EVAPORATOR LWT (°F)	EVAPORATOR PASS	EVAPORATOR MAX. PD (FT)	EVAPORATOR FOULING FACTOR	REMARKS OWNER PRE-PURCHASED AND FURNISHED TO THE CONTRACTOR
1E	CHILLER BAY-GROUND LEVEL	CENT	1,400	0.612	2,400	56	42	2	18.1	0.0001	
2E	CHILLER BAY-GROUND LEVEL	CENT	1,400	0.612	2,400	56	42	2	18.1	0.0001	
3E	CHILLER BAY-GROUND LEVEL	CENT	1,400	0.612	2,400	56	42	2	18.1	0.0001	

CHILLERS

MARK (CRM)	CONDENSER GPM	CONDENSER EWT (°F)	CONDENSER LWT (°F)	CONDENSER PASS	CONDENSER MAX. PD (FT)	CONDENSER FOULING FACTOR	ELECTRICAL MAX. POWER INPUT (KW)	ELECTRICAL FLA	ELECTRICAL LRA	ELECTRICAL INRUSH	ELECTRICAL VOLTS	ELECTRICAL PH	STARTER TYPE
1E	4,200	85	95	2	18.5	0.00025	858	1080	6235	-	480	3	VFD (UNIT MOUNTED)
2E	4,200	85	95	2	18.5	0.00025	858	1080	6235	-	480	3	VFD (UNIT MOUNTED)
3E	4,200	85	95	2	18.5	0.00025	858	1080	6235	-	480	3	VFD (UNIT MOUNTED)

COOLING TOWERS

MARK (CTF)	LOCATION	GPM EACH CELL	MAX. PD (FT) (2)	TEMPERATURE (°F) AIR WB	TEMPERATURE (°F) EWT	TEMPERATURE (°F) LWT	FAN MOTOR MAX. HP	FAN MOTOR VOLT	FAN MOTOR PHASE	REMARKS OWNER PRE-PURCHASED AND FURNISHED TO THE CONTRACTOR
301E	EQUIPMENT YARD SOUTH OF PLANT	4200	25	80	95	85	125	480	3	(1)
302E	EQUIPMENT YARD SOUTH OF PLANT	4200	25	80	95	85	125	480	3	(1)
303E	EQUIPMENT YARD SOUTH OF PLANT	4200	25	80	95	85	125	480	3	(1)

NOTES:
(1) PROVIDED WITH DIRECT DRIVE PMR TYPE MOTORS AND COMPANION VFDS.
(2) FROM INLET FLANGE CONNECTION.

VARIABLE FREQUENCY DRIVES

23 0514

MARK (VFD)	EQUIPMENT	LOCATION	HP	VOLTS	RPM	PULSE	INPUT CIRCUIT BREAKER	INPUT LINE REACTOR	OUTPUT DV/DT FILTER	BYPASS STARTER	HARMONIC TRAP	SINGLE ENCLOSURE	NEMA ENCLOSURE TYPE	SCCR (MIN)	REMARKS OWNER PRE-PURCHASED AND FURNISHED TO THE CONTRACTOR
P-201E	CHW PUMP	MECHANICAL ROOM	200	480	1800	6	Y	Y	N	N	N	Y	12	65kAIC	
P-202E	CHW PUMP	MECHANICAL ROOM	200	480	1800	6	Y	Y	N	N	N	Y	12	65kAIC	
P-203E	CHW PUMP	MECHANICAL ROOM	200	480	1800	6	Y	Y	N	N	N	Y	12	65kAIC	
P-101E	CW PUMP	MECHANICAL ROOM	200	480	1200	6	Y	Y	N	N	N	Y	12	65kAIC	
P-102E	CW PUMP	MECHANICAL ROOM	200	480	1200	6	Y	Y	N	N	N	Y	12	65kAIC	
P-103E	CW PUMP	MECHANICAL ROOM	200	480	1200	6	Y	Y	N	N	N	Y	12	65kAIC	
CTF-301E	CT FAN	EXTERIOR ELECTRICAL ENCLOSURE	125	480	180	6	Y	Y	N	N	N	Y	1	65kAIC	
CTF-302E	CT FAN	EXTERIOR ELECTRICAL ENCLOSURE	125	480	180	6	Y	Y	N	N	N	Y	1	65kAIC	
CTF-303E	CT FAN	EXTERIOR ELECTRICAL ENCLOSURE	125	480	180	6	Y	Y	N	N	N	Y	1	65kAIC	

VALVES

23 0902

MARK	LOCATION	SYSTEM	SERVICE	TYPE	OPERATING	SIZE (IN)	GPM	Cv@100% STROKE MIN	Cv@100% STROKE MAX	SHUTOFF PRESSURE DIFFERENTIAL (PSIG)	FAIL POSITION FC, FO OR FIP (1)	ACTUATOR TYPE	ACTUATOR VOLTAGE	REMARKS
FCV/201E	CHILLER ROOM	CHS	CRM 1E	BUTTERFLY	MODULATING	10	2,400	3,500	4,500	100	FIP	ELECTRIC	120	
FCV/202E	CHILLER ROOM	CHS	CRM 2E	BUTTERFLY	MODULATING	10	2,400	3,500	4,500	100	FIP	ELECTRIC	120	
FCV/203E	CHILLER ROOM	CHS	CRM 3E	BUTTERFLY	MODULATING	10	2,400	3,500	4,500	100	FIP	ELECTRIC	120	
TCV/200E	CHILLER ROOM	CHR	MINIMUM FLOW / STARTUP BYPASS	BUTTERFLY	MODULATING	6	1,200	400	500	100	FIP	ELECTRIC	120	
FCV/101E	CHILLER ROOM	CWR	CRM 1E	BUTTERFLY	MODULATING	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
FCV/102E	CHILLER ROOM	CWR	CRM 2E	BUTTERFLY	MODULATING	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
FCV/103E	CHILLER ROOM	CWR	CRM 3E	BUTTERFLY	MODULATING	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
TCV/300E	CHILLER ROOM	CWR	TOWER BYPASS	BUTTERFLY	MODULATING	8	2,100	2,000	2,500	100	FIP	ELECTRIC	120	
FV/301E	EQUPMENT YARD	CWR	CTF 1E	BUTTERFLY	TWO POSITION	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
FV/302E	EQUPMENT YARD	CWR	CTF 2E	BUTTERFLY	TWO POSITION	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
FV/303E	EQUPMENT YARD	CWR	CTF 3E	BUTTERFLY	TWO POSITION	14	4,200	7,000	8,000	100	FIP	ELECTRIC	120	
LCV/350E	CHILLER ROOM	RCW	CONDENSER WATER MAKE-UP	V-BALL	MODULATING	3	200	200	225	100	FC	ELECTRIC	120	
LCV/300E	CHILLER ROOM	DCW	CONDENSER WATER MAKE-UP	V-BALL	MODULATING	3	200	200	225	100	FC	ELECTRIC	120	
FCV/300E	CHILLER ROOM	CWR	TOWER BLEED	V-BALL	MODULATING	2	65	-	-	100	FC	ELECTRIC	120	
FV/350E	CHILLER ROOM	RCW	RECLAIM WATER MAKE-UP SAMPLE	BALL	TWO POSITION	1	-	-	-	100	FC	ELECTRIC	120	STAINLESS STEEL BODY, BALL, ETC.
PCV/800AE	CHILLER ROOM	DCW	CHILLED WATER MAKE-UP	V-BALL	MODULATING	2	80	27	32	100	FC	ELECTRIC	120	30 DEGREE PORT ANGLE
PCV/800BE	CHILLER ROOM	DCW	CHILLED WATER MAKE-UP	V-BALL	MODULATING	4	470	330	350	100	FC	ELECTRIC	120	90 DEGREE PORT ANGLE

(1) FC=FAIL CLOSED, FO=FAIL OPEN, FIP=FAIL IN PLACE

WATER FLOW METERS

23 0903

MARK (FIT)	SYSTEM	SERVICE	TYPE	CAPACITY (GPM)	SIZE (IN)	MAX. PD (FT)	VOLTAGE	REMARKS
800E	DCW	CHILLED WATER MAKE-UP	INLINE MAGNETIC	80	2	N/A	24VDC	
801E	DCW	CHILLED WATER MAKE-UP	INLINE MAGNETIC	470	4	N/A	24VDC	
200E	CHS	MINIMUM FLOW BYPASS	INLINE MAGNETIC	1200	10	N/A	24VDC	
201E	CHR	CRM 1E	INLINE MAGNETIC	2400	10	N/A	24VDC	
202E	CHR	CRM 2E	INLINE MAGNETIC	2400	10	N/A	24VDC	
203E	CHR	CRM 3E	INLINE MAGNETIC	2400	10	N/A	24VDC	
101E	CWS	CRM 1E	INLINE MAGNETIC	4200	14	N/A	24VDC	
102E	CWS	CRM 2E	INLINE MAGNETIC	4200	14	N/A	24VDC	
103E	CWS	CRM 3E	INLINE MAGNETIC	4200	14	N/A	24VDC	
300E	CWS	TOWER BLEED	INLINE MAGNETIC	65	2	N/A	24VDC	
350E	RCW	CONDENSER MAKEUP	INLINE MAGNETIC	200	4	N/A	24VDC	
300E	DCW	CONDENSER MAKEUP	INLINE MAGNETIC	200	4	N/A	24VDC	

PUMPS

MARK (P)	LOCATION	SERVICE	TYPE	CAP. (GPM)	HEAD (FT)	MAX. NPSHR (FT)	MIN. EFF. (%)	SIZE (IN) SUCT.	SIZE (IN) DISCH.	ELECTRICAL CHARACTERISTICS MOTOR VFD	HP	RPM	VOLT	PH	REMARKS OWNER PRE-PURCHASED AND FURNISHED TO THE CONTRACTOR
201E	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	3600	160	19.2	85.5.	12	10	YES	200	1800	480	3	
202E	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	3600	160	19.2	85.5	12	10	YES	200	1800	480	3	
203E	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	3600	160	19.2	85.5	12	10	YES	200	1800	480	3	
101E	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	6300	90	13.2	85.5	16	14	YES	200	1200	480	3	
102E	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	6300	90	13.2	85.5	16	14	YES	200	1200	480	3	
103E	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	6300	90	13.2	85.5	16	14	YES	200	1200	480	3	

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12/06/24

Sheet Keynotes:

Rev	Date	Description of Issue
B	10/18/24	CD FOR REVIEW
A	05/24/24	SD / DD

Project

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

Chilled Water Infrastructure Expansion
SCO# 22-25588-02B
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UNC BLDG. NO 505

Sheet Title

MECHANICAL SCHEDULES

Scale: NONE

Date: 10/18/24 Drawn By: DDC

Project No.: 23480-02 Checked By:

Sheet No.

E.M.601