STATE OF NORTH CAROLINA

The University of North Carolina at Chapel Hill

Invitation for Bid #: 3000012537

Chilled Water Infrastructure Expansion Bernard Chiller Plant

Date Issued: 10/28/2025

Submit Written Questions: 10/31/2025 at 1:00PM EST

Bid Opening Date: 11/12/2025

At 01:00 PM EST

Direct all inquiries concerning this IFB to:

Marcy Moore

MRO Category Manager

Email: Mmrowlan@unc.edu

STATE OF NORTH CAROLINA

Invitation for Bids

3000012537

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: **Marcy Moore**	**Invitation for Bids # 3000012537** **Bids will be publicly opened: 11/12/25 at 1:00PM**
Using Agency: University of Chapel Hill **Requisition No.: 1001094039**	**Commodity No. and Description: Prepurchased Equipment Electric Centrifugal Chillers**

If you would like to join for opening, please use the link below.

https://us04web.zoom.us/j/79146213590?pwd=ipVb6CuaLcfWXkDaEtryR8aTq8a6Ae.1

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 University of Chapel Hill)

1.0 PURPOSE AND BACKGROUND

A. This equipment will be prepurchased by the Owner 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 by the Contractor and set/reassembled at the jobsite.

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

1.1 CONTRACT TERM

This section intentionally omitted

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 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 purport 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 nonresponsive.

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	10/28/2025
Hold Pre-Bid Conference/Site Visit	University	N/A
Submit Written Questions	Vendor	10/31/2025 at 1:00PM EST
Provide Responses to Questions	University	ASAP
Submit Bids	Vendor	11/12/25 at 1:00PM EST
Contract Award	University	ASAP
Contract Effective Date	University	ASAP

2.5 SITE VISIT or PRE-BID CONFERENCE

This section intentionally omitted.

2.6 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 *mmrowlan@unc.edu* by the date and time specified above. Vendors will enter "IFB - *3000012537:* Questions" as the subject for the email. Question submittals will include a reference to the applicable IFB section and be submitted in a 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.

If applicable to this IFB and using 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) 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) Title Page: Include the company name, address, phone number and authorized representative along with the Bid Number.

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

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

e) Completed version of ATTACHMENT A: PRICING

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

g) Completed version of ATTACHMENT E: CUSTOMER REFERENCE FORM

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

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

j) Completed and signed version of ATTACHMENT H: VENDOR REQUEST FOR EO50 PRICE-MATCHING, if applicable

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 advantage(s) 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 the 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 have been 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. Prices 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.

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 is 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 AND INSTALLATION

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.

DELIVERY BY EQUIPMENT MANUFACTURER

A. Assembled chiller or all major components (compressor, evaporator, condenser, and intercooler) to be factory leak tested evacuated and protectively charged with nitrogen before shipment by the Manufacturer.

B. Each unit shall include initial charge of refrigerant shipped separately by bulk tank delivery, initial charge of compressor and driveline component oil shipped separately.

C. Any sensor or other device protruding from the equipment shall be protected from normal shipping hazards by the Manufacturer.

D. Secure all component connections to protect mating surfaces and keep out foreign materials.

E. The Manufacturer shall shrink wrap each entire unit with an environmentally recyclable material standard. The material shall include an imbedded desiccant to minimize/eliminate internal moisture.

F. Units shall be shipped by the Manufacturer with attached metal plates that indicate name of manufacturer, chiller model number, compressor type, refrigerant type and quantity.

G. Upon delivery, Manufacturer shall Advise the Contractor in regard to proper rigging methods and reassemble the chiller inside the plant as required, and perform a leak test matching factory requirements. Once leak test is complete, the Manufacturer shall evacuate the chiller and protectively charge the chiller with nitrogen until it is ready to be charged and put into service.

INSTALLATION BY EQUIPMENT MANUFACTURER

A. Intent is to provide for equipment that meets all functional and applicable code requirements. This includes but is not limited to all electrical, controls (including the Owner's plant control system), piping, drains, vents and mounting. This manufacturer shall be responsible for coordinating all such requirements of units provided under this specification with the Contractor and the Owner. Any additional installation or redesign costs associated with the installation of the equipment provided that is different than that illustrated on the submitted shop drawings shall be the responsibility of the equipment manufacturer.

B. A factory-trained service representative of the manufacturer shall supervise the fieldassembly (if any), final installation, pressure testing, checkout, start-up, adjusting and balancing of the chiller. Prepare and submit manufacturer's written report/log of the installation and start-up signed by the service representative and the Owner. The Manufacturer's Representative shall supervise leak testing, evacuation, dehydration, and charging of oil and refrigerant. If the chiller is found to have lost its shipping pressure prior to the time of installation, then the machine shall be leak tested, and shall be evacuated a minimum of 24 hours. Other special provisions for unit testing and setups as recommended by the equipment

manufacturer in operations and maintenance manuals shall also be followed. The Manufacturer shall provide 40 hours of time for each chiller.

C. Before acceptance by Owner/Designer, unit manufacturer shall approve, in writing, the complete installation, including piping and wiring connections, and proper functioning of all operational and protective/safety controls.

DELIVERY BY INSTALLING CONTRACTOR

A. Contractor to coordinate and expedite delivery of equipment to the project site with the manufacturer and provide unloading and rigging of equipment into place as part of setting/installation process as recommended or required by the manufacturer.

B. Units will be stored and handled in accordance with Manufacturer's instructions by the Contractor.

C. Contractor will protect chiller and controls from physical damage and Contractor will leave factory shipping covers in place until installation.

INSTALLATION BY INSTALLING CONTRACTOR

A. Receiving, rigging and setting of chillers and associated refrigerant pump out unit including coordination of exact delivery date with Manufacturer.

B. Install equipment as shown on drawings, and in accordance with manufacturer's installation instructions.

C. Provide concrete housekeeping pads/curbs and install rubber isolation pads provided by equipment manufacturer under chiller support feet.

D. Extend chilled water, condenser water, any auxiliary water, and refrigerant pump out system piping as required by the equipment and insulate each as specified.

E. Pipe refrigerant relief devices and any purge unit vents to building exterior. Discharge pipes shall not be less than relief device outlet size. Discharge from more than one relief device or purge unit per refrigeration machine may be combined into a common header, provided cross-sectional area of common header is at least sum of the crosssectional areas of the connected pipes. When length of discharge piping exceeds 50 feet, piping shall be increased one pipe size.

F. Piping connections shall not create stress on chiller flanges and nozzles. After final connections are completed, remove bolts from flanged connections at chillers. Piping shall remain aligned after bolts have been removed, or if bolts cannot be removed by hand, revise piping to align piping with chiller connection. Piping/chiller alignment verification shall be completed in the presence of the Owner’s representative. If after completion of the strain-free verification of the piping system must be disassembled at any point in the system, the strain-free verification shall be repeated.

G. Install control devices, raceway systems and/or wiring between the chillers and VFD’s and the Owners control system.

H. Extend electrical service to the chillers including feeders to the VFD’s, motors and associated auxiliary devices.

I. Touch up paint on the entire chiller prior to applying insulation.

J. Install necessary piping with insulation for lubricating system cooler if required

K. All chiller surfaces below 65°F when the chiller is operation shall be insulated by the Contractor after all piping connections are made to eliminate any condensation from forming and dripping on the plant floor. This includes, but is not limited to the

evaporator shell, water boxes, cover plates, suction elbow, vent and drain connections, etc. Water piping and connections shall also be insulated by the Contractor.

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

M. 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.

N. 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.

See attached Chiller Water Infrastructure Expansion Bernard Chiller Plant – Prepurchased Equipment Electric Centrifugal Chillers Bid Set for additional information.

4.6 AUTHORIZED RESELLER

This section is intentionally omitted

4.7 WARRANTY

Manufacturer's standard warranty shall apply. Vendors shall include a copy of the manufacturer's standard warranty with the bid response.

Vendor warrants that all equipment furnished under this IFB will be newly manufactured, of good material and workmanship. The warranty will apply from date equipment is put into operation for a minimum period of twelve (12) months or the length of the manufacturer's warranty, whichever is longer. Such 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. 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. Vendor shall be responsible for compliance with warranty terms by any third-party service provider. Vendor shall provide contact information for warranty service provider, below.

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

Will the Vendor provide 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

This section is intentionally removed.

4.9 DESCRIPTIVE LITERATURE

DESCRIPTIVE LITERATURE/CERTIFICATION

Each bid shall be accompanied by complete descriptive literature, specifications, certifications, and all other pertinent data necessary for thorough evaluation of the item(s) offered and sufficient to determine compliance of the item(s) with the specifications. Failure to include such information to shall be a sufficient basis for rejection of the bid.

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 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 is intentionally omitted. Please see standard Terms and Conditions attached.

4.15 NC COVID-19 VACCINATION AND TESTING REQUIREMENT

This section intentionally omitted.

4.16 FEDERAL COVID-19 VACCINATION REQUIREMENT

This section is intentionally omitted.

4.17 LOBBYING ACTIVITY CERTIFICATION FOR FEDERAL GRANTS

This section is intentionally omitted.

5.0 PRODUCT SPECIFICATIONS

5.1 SPECIFICATIONS

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

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

Pre-purchased Equipment Electric Centrifugal Chillers Bid Set

A. Provide ten (10) 1,250 ton chillers or five (5) 2,500 ton chillers configured to operate in series-counterflow arrangement. Electric, 480V, factory assembled, centrifugal chillers complete with compressor, motor, unit mounted variable speed drive (VSD) / adjustable frequency drive (AFD), evaporator, condenser, microprocessor based integrated controls, graphics and all required ancillary equipment including permanent refrigerant pump out unit. The chillers will be field installed to operate in a headered, variable primary chilled water pumping system. The chillers will also be connected to a headered condenser water system with five (5) field erected cooling towers.

B. Each series-counterflow chiller or pair of chillers shall have a guaranteed capacity of 2,500 tons at the design conditions that are listed in the table in Part 5 of this section.

C. The maximum chiller dimensions for each individual chiller in the series-counterflow pair cannot exceed the following

1. 1,250 Ton Series-Counterflow chillers:

    a. Overall unit length: 24’-6”.

    b. Chiller width including unit mounted VSD: 11'-9".

    c. Chiller height: 12’-0”.

2. 2,500 Ton Series-Counterflow chillers:

    a. Overall unit length: 29-0”.

    b. Chiller width including unit mounted VSD: 13'-6".

    c. Chiller height: 12’-0”.

D. The opening to rig the chillers into the Bernard Chiller Plant (BCP) is through a vertical bifold door on the north side of the plant. The clear opening of this door is approximately 20’-0” wide and 18’-0” tall.

Please see attached Chilled Water Infrastructure Expansion Bernard Chiller Plant – Prepurchased Equipment Electric Centrifugal Chillers Bid Set Document for additional details.

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 is intentionally omitted.

6.2 POST AWARD PROJECT REVIEW MEETINGS

This section is intentionally omitted.

6.3 CONTINUOUS IMPROVEMENT

The University encourages the Vendor to identify opportunities to reduce the total cost the University. A continuous improvement effort consisting of various ideas to enhance business efficiencies as performance progresses.

6.4 PERIODIC STATUS REPORTS

This section is 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.

Acceptance of work products shall be based on the following criteria: See Scope of work.

The University shall have the obligation to notify Vendor, in writing ten (10) calendar days following completion of such work or delivery of a deliverable described in the Contract that it is not acceptable. The notice shall specify in reasonable detail the reason(s) it is unacceptable. Acceptance by the University shall not be unreasonably withheld; but may be conditioned or delayed as required for reasonable review, evaluation, installation, or testing, as applicable to the work or deliverable. Final acceptance is expressly conditioned upon completion of all applicable assessment procedures. Should the work or deliverables fail to meet any specifications, acceptance criteria or otherwise fail to conform to the Contract, the University may exercise any and all rights hereunder, including, for Goods deliverables, such rights provided by the Uniform Commercial Code, as adopted in North Carolina.

6.6 INVOICES

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

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 resolution. Any claims by the University shall be submitted in writing to the Vendor's Project Manager for 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.

6.9.1 PRICE ADJUSTMENTS

Prices proposed by the Vendor shall be firm against any increase for 60 days from the effective date of the Contract.

Price increase requests shall be submitted in writing to the Contract Lead, which shall include the reason(s) for the request and contain supporting documentation for the need. Price increases will be negotiated and agreed to by both the University and Vendor in advance of any price increase going into effect. The University is not obligated to accept pricing adjustments or increases and reserves the right to accept or reject them in part or in whole. Price de-escalation or decreases may be requested by the University at any time.

It is understood and agreed that orders will be shipped at the established Contract prices in effect on the date an order is placed. Invoicing that deviates from this provision may result in Contract to cancellation.

6.10 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.

The remainder of this page is intentionally left blank

7.0 ATTACHMENTS

IMPORTANT NOTICE

RETURN THE REQUIRED ATTACHMENTS WITH YOUR RESPONSE

FOLLOW THE LINKS TO ACCESS EACH ATTACHMENT

ATTACHMENT A: PRICING

No attachment associated with this IFB. Please submit 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://www.doa.nc.gov/divisions/purchase-contract/vendor-forms

ATTACHMENT C: NORTH CAROLINA GENERAL TERMS & CONDITIONS

The North Carolina 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/divisions/purchase-contract/vendor-forms

ATTACHMENT E: CUSTOMER REFERENCE FORM

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

https://www.doa.nc.gov/divisions/purchase-contract/vendor-forms

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/divisions/purchase-contract/vendor-forms

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/divisions/purchase-contract/vendor-forms

ATTACHMENT H: VENDOR REQUEST FOR EO50 PRICE-MATCHING

Complete, sign, and return the Vendor Request for EO50 Price-Matching, which can be found at the following link:

https://www.doa.nc.gov/divisions/purchase-contract/vendor-forms

***** 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 Bernard Chiller Plant

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

Prepurchased Equipment Electric Centrifugal Chillers 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. 23480-01

October 22, 2025

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CERTIFICATION

10/22/25

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SECTION 23 6000
PRIMARY COOLING EQUIPMENT

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 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 by the Contractor and set/reassembled at the jobsite.

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. Equipment Delivery: March 2027
      b. Installation, Start-Up & Commissioning: November 2027 – March 2028

B. Manufacturer shall be able to produce, test, and deliver the equipment (FOB) to a location dictated by the Contractor per the schedule described above.

C. 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 DESCRIPTION

A. Provide ten (10) 1,250 ton chillers or five (5) 2,500 ton chillers configured to operate in series-counterflow arrangement. Electric, 480V, factory assembled, centrifugal chillers complete with compressor, motor, unit mounted variable speed drive (VSD) / adjustable frequency drive (AFD), evaporator, condenser, microprocessor based integrated controls, graphics and all required ancillary equipment including permanent refrigerant pump out unit. The chillers will be field installed to operate in a headered, variable primary chilled water pumping system. The chillers will also be connected to a headered condenser water system with five (5) field erected cooling towers.

B. Each series-counterflow chiller or pair of chillers shall have a guaranteed capacity of 2,500 tons at the design conditions that are listed in the table in Part 5 of this section.

C. The maximum chiller dimensions for each individual chiller in the series-counterflow pair cannot exceed the following

1. 1,250 Ton Series-Counterflow chillers:
    a. Overall unit length: 24’-6”.
    b. Chiller width including unit mounted VSD: 11'-9".
    c. Chiller height: 12’-0”.
2. 2,500 Ton Series-Counterflow chillers:
    a. Overall unit length: 29-0”.
    b. Chiller width including unit mounted VSD: 13'-6".
    c. Chiller height: 12’-0”.

D. The opening to rig the chillers into the Bernard Chiller Plant (BCP) is through a vertical bifold door on the north side of the plant. The clear opening of this door is approximately 20’-0” wide and 18’-0” tall.

1.4 EVALUATION CRITERIA

A. As provided by Statute, award will be based on the best overall value (most advantageous to the State) as determined by consideration of the following (not necessarily in priority order):
   1. Conformity with terms and conditions of this Invitation for Bids.
   2. Price relative to the project funding/budget.
   3. Completeness of literature submitted with bid per Article 1.6 below.
   4. Conformity with the specification herein.
   5. Delivery compliance.
   6. Status as authorized dealer or manufacturer's representative and service providers.
   7. Feedback from submitted references.
   8. Ability to provide Factory Testing of equipment over full operating range.
   9. Physical size and weight of equipment and components.
   10. Cost of adjustments in piping and electrical systems from basis of design layout shown on drawings to accommodate proposed equipment.
   11. Acoustical performance.
   12. Life cycle cost including chiller compressor and related pumping energy.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The equipment Manufacturer shall provide Industrial equipment that is the manufacturer's standard product.

B. Service Representatives: The equipment service representative shall be a factory trained and certified agent of the equipment manufacturer.

C. Single source responsibility: Provide a source with responsibility and accountability to answer and resolve problems regarding compatibility, installation, performance and service. All chiller components, which includes VSD/AFD shall be supplied and serviced by chiller manufacturers local branch organization.

D. Comply with referenced code and standards. Provide listings/approval stamp, label or other markings on equipment made to specified codes or standards.

E. Codes and Standards: Products shall be designed, tested, rated, and installed in compliance with the latest edition of the following standards, as applicable.
   1. ANSI/ASHRAE STANDARD 15 - Safety Code for Mechanical Refrigeration.
   2. ANSI/ASHRAE 90.1 Energy-Efficient Design of New Nonresidential & High-Rise Residential Buildings.
   3. ASME Boiler and Pressure Vessel Code/Section VIII, Division 1.
   4. AHRI Standard 550 / Centrifugal or Rotary Water Chilling Packages.
   5. ASME B31.5 Code for Pressure Piping – Refrigerant Piping.
   6. ABMA – Anti-Friction Bearing Manufacturer's Association.
   7. HEI - Heat Exchange Institute

F. Ratings and Certifications: Products shall be rated and certified in accordance with the following:
   1. Conform to AHRI Standard 550/590 for rating and testing of centrifugal chillers.
   2. Conform to UL 465 for construction of centrifugal chillers and provide UL/CUL label.
   3. Conforms to ASME Boiler and Pressure Vessel Code/Section VIII, Division 1.
   4. Conform to ANSI/ASHRAE Standard 15 (latest edition) for construction and operation of centrifugal chillers, safety code for Mechanical Refrigeration.

1.6 BID SUBMITTALS

A. The following shall be provided with the equipment bid proposal:
   1. Complete chiller bid summary data sheet and Life Cycle Cost Analysis Form 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 for each chiller. Voluntary alternates will be accepted and considered for evaluation.
   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.
   3. Detailed drawings of the proposed equipment shall be provided including a top view, right side view, left side view and front view. The drawings shall indicate the dimensions of the unit, locations and sizes of all connections, and recommended service clearances.
   4. Detailed electrical wiring diagram that indicates all required field wiring for power, control and communication.
   5. Detailed description of controls interface requirements (physical and communication) between the equipment’s local control system and the plant/Owner’s Distributed Control System (DCS).

B. Product data including:
   1. Type of motor (open or hermetic).
   2. Number of compressors and stages.
   3. Type of refrigerant.
   4. Refrigerant charge (lbs).
   5. Number and type of bearings.

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.

1.7 FABRICATION SUBMITTALS

A. Shop Drawings: Detail chiller and auxiliary equipment assemblies and indicate plans, elevations, sections, component details, attachments, and other construction elements. Include the followings:

B. General

1. Manufacturer's name and model number
2. Identification as referenced in the documents
3. Type of chiller - principle of operation
4. Installation and operating manuals.
5. Manufacturers signed report/log of the installation and start-up.
6. Performance
7. Refrigerant Type
8. Capacity (Tons)
9. Compressor and product data in table form indicating impeller speed (RPM), number of bearings, type of bearings, high speed impeller shaft RPM, number of stages, number of sets of inlet guide vanes, amount of refrigerant charge (lbs), and amount of oil required (gal).
10. Compressor performance curves, compressor surge map
11. Chilled-Water Temperatures-EWT in Deg. F
12. Chilled-Water Flow in GPM
13. Evaporator Pressure Drop in Feet
14. Evaporator Fouling Factor.
15. Condenser Water Temperatures-EWT in Deg F, -LWT in Deg F.
16. Condenser Water Flow in GPM.
17. Condenser Pressure Drop in Feet.
18. Condenser Fouling Factor.
19. Certified performance data with and without “zero tolerance” requirements specified herein.
20. Sound ratings.
21. Heat rejection to plant space (Btu/hr).

C. Physical and Dimensional

1. Materials of construction.
2. General arrangement drawings in .pdf and 3D CAD/Revit files.
3. Assembled unit dimensions.

4. Weight loadings, distribution and structural supports.
5. Required clearances for maintenance and operation, including working clearances for mechanical controls and electrical equipment.
6. Size and location of field connections and piping installation requirements.
7. Auxiliary equipment descriptions.

D. Electrical and Controls
1. Compressor (kW), Full Load Amps, Locked Rotor Amps
2. Motor data
3. Unit mounted VSD/AFD Data
4. Complete interlocking and line diagrams of all electrical wiring required between machine control panel, ASD/VSD, temperature control devices and the chiller plant's control system.
5. Wiring and interlocking diagram shall include all components of system such as chillers, cooling towers, system pumps, automatic valves, flow switches.
6. Differentiate between manufacturer-installed and field-installed wiring.
7. Controls description
8. P&ID's (chilled water, condenser water, and refrigerant)
9. MODBUS object list for each chiller.

E. Complete description of the proposed equipment maintenance training program including dates and locations. Include a complete listing of all documentation that will be provided during training program. This may include installation manuals, operation full maintenance and overhaul manuals, service manuals and bulletins, troubleshooting guides, etc.

F. Factory Test Reports: Perform and interpret test results for compliance with specifications requirements as appropriate.

1.8 OPERATION AND MAINTENANCE MANUAL SUBMITTAL

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.

1.9 SPARE PARTS

A. Provide chiller and VSD manufacturer's recommended complete spare parts kit and address of local supplier stocking location. Spare parts shall be labeled with name and part number. Spare parts shall be stored on-site.

B. Three (3) spare sets of sacrificial anodes for the project.

C. One (1) quart of finish paint shall be provided with each chiller.

D. Turnover any chiller control panel or VSD enclosure keys to the Owner.

1.10 WARRANTY

A. Equipment Manufacturer shall provide five (5) year full parts and labor warranty from the date of Project Final Acceptance for the complete chiller and associated systems including unit mounted variable speed drives, and associated auxiliaries, including refrigerant, oil and start-up services. Start-up services and labor warranty shall be performed by factory employed service technicians. Manufacturer shall agree to replace any and all chiller related components that are provided on the project at no cost to the Owner during the selected warranty period.

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 CENTRIFUGAL REFRIGERATION MACHINES

A. Acceptable Manufacturers:
   1. Carrier
   2. Daikin
   3. Trane
   4. York

B. General:

1. The chiller shall be designed, selected, and constructed to use refrigerant R-513a, R-514a, or R-1233zd(E) and meet the capacity requirements specified herein. Units with low pressure refrigerants shall also be provided with high efficiency purge. All chillers shall be provided with a full charge of oil and refrigerant.
2. Chiller shall consist of, but not limited to, a complete system with compressor, motor, evaporator, condenser, lubrication system, integral sub-cooler or flash economizer, capacity controller, control panel, unit mounted variable speed drive, and other items as specified herein or required.

C. Performance

1. Bids shall include name of manufacturer, model number, and performance data, including capacity (tons (kW)), input electrical power (KW), part load data at 100%, 85%, 80% and 75% and kW/tons (kW/kW) (IPLV value) in accordance with AHRI Standard 550/590-98 and maximum sound pressure measured in accordance with AHRI Standard 575-94.
2. Chillers shall conform to the latest edition of ASHRAE 15 Safety Code.
3. Evaporator shall be designed to allow for the flow rate to be reduced to the rate of 1.0 gpm per ton without entering laminar flow to allow for variable chilled water flow and facilitate chilled water pump energy savings. The chiller shall be able to operate in a stable fashion at this condition for at least 8 hours continuously independent of condenser water flow rate or condenser water temperature relief.
4. Condenser shall be designed to allow for the flow rate to be reduced to 1.5 gpm per ton without entering laminar flow to allow for variable condenser water flow and facilitate condenser water pump energy savings. The chiller shall be able to operate in a stable fashion at this condition for at least 8 hours continuously independent of chiller water flow rate or condenser water temperature relief.
5. Each chiller shall be capable of extended operation and start-up with 55°F entering condenser water temperature (ECWT) to take full advantage of off-design performance. Manufacturer shall provide a written guarantee, signed by and officer of the company, that the chiller will operate continuously at low ECWT. Variations in condenser water flow may be permitted, but must be noted at the time of submission of the bid.

D. Evaporator and Condenser Vessels:

1. Single-pass, shell-and-tube type, designed and constructed and stamped and registered with National Board, in accordance with the latest ASME Code Section VIII, Division 1 for unfired pressure vessels. Provide taps for vents and drains.
    a. Design water side for 150 psig working pressure and perform hydrostatic pressure test at 225 psig.
    b. The refrigerant side shall be hydrostatically tested at Manufacturer's factory in accordance with ASME Code. Low pressure machines may be air tested in lieu of hydro tested and tested in accordance with the ASME Code.
2. Evaporator and condenser shells to be fabricated from carbon steel. Tube sheets to be carbon steel, drilled and reamed to accommodate the tubes, and welded to the end of each shell. Intermediate tube supports to be fabricated of carbon steel plates, maximum spacing 4'-0".

3. Each tube shall be roller expanded into the tube sheets providing a leak-proof seal. Tubes to be individually cleanable and replaceable with tube ends rolled into annular grooves/holes in tube sheets.
    a. Condenser tubes to be seamless copper tubing with minimum tube wall thickness of 0.028" at the root of any fins. All condenser tubes shall be the exact same diameter to accommodate an automatic tube cleaning system.
    b. Evaporator tubes to be seamless copper tubing with minimum tube wall thickness of 0.025" at the root of any fins.
4. A suction baffle or aluminum mesh eliminators shall be installed along the entire length of the evaporator to prevent liquid refrigerant carry over into the compressor. Oil eductors, capable of returning oil to the oil sump, shall be provided on all evaporators.
5. Evaporator shall be of such design to prevent liquid refrigerant from entering compressor.
6. Provide two (2) 2” sight glasses on chiller vessels to view refrigerant levels.
7. Size and location main evaporator and condenser fluid piping connections shall be as shown on the drawings.
    a. Piping connections to unit 2-1/2" in diameter and larger shall be flanged type, Class 150, welding neck style, ASTM A181 or A105, ANSI B16.5, hot forged steel. Slip on type flanges or grooved connections are not acceptable. Piping connections to unit 2" in diameter and smaller shall be screwed FNPT.
8. Furnish marine water boxes on the pipe connection end of chillers and hinged cover plates on the opposing end. Marine water boxes shall be equipped with hinged or davited cover plates for complete access for condenser and evaporator without removal of system piping on either end. Water boxes shall have vents (where the condenser water box can be provided with automatic air vents), drains, covers and suitable tappings for control sensors, gauges and thermometers.
9. Provide factory applied protective epoxy coating on all wetted steel surfaces of the condenser bundles.
    a. Coating shall be warranted by the Chiller Manufacturer for no less than the same warranty period as the chiller.
    b. Surface preparation to be performed in strict accordance with coating manufacturer’s instructions.
    c. Stainless steel materials shall be provided where a coating is ineffective in protecting the substrate such as on the removable waterbox baffles, baffle channels, and threaded couplings.
    d. Waterboxes shall be designed and constructed to facilitate protective coating performance, considerations such as no sharp edges or internal seams included.
    e. The assembled bundles shall be hydro leak tested after coating is applied.
10. Provide sacrificial magnesium anodes on each end of the condenser bundles of every chiller. Anodes shall be replaceable from the outside without removal of the end plate. The quantity of anodes is based on the size and volume of the chiller and shall be determined by the chiller manufacturer. All hardware associated with the mounting/attachment of the sacrificial anodes shall be stainless steel.

E. Compressors:
1. Shall be direct driven or gear driven, single or multiple stage design.
2. Capacity control shall be provided by fully modulating variable inlet guide vanes and shall allow capacity modulation from 100% to 15% of design capacity without hot gas bypass.
3. Airfoil shaped cast manganese bronze pre-rotation guide vanes (PRV) shall be precisely positioned by solid vane linkages connected to an externally mounted electric PRV actuator.
4. Compressor shall have a cast-iron casing.
5. Impeller shall be high strength, cast aluminum-alloy, statically and dynamically balanced.
6. Compressor assembly shall be overspeed tested at the factory at minimum of 115% of the design impeller shaft speed.
7. Balance and align motor-compressor assembly to a maximum vibration amplitude of 1.0 mil as measured at the shaft.
8. Factory alignment and vibration reports shall be completed and submitted to the Designer.
9. Chiller shall be able to unload down to 25% at constant entering condenser water (85 F) without going into surge.

F. Compressors coupled with Open Motor:
1. Shall be direct driven or gear driven, single or multiple stage design.
2. Capacity control shall be provided by fully modulating variable inlet guide vanes and shall allow capacity modulation from 100% to 15% of design capacity without hot gas bypass.
3. Airfoil shaped cast manganese bronze pre-rotation guide vanes (PRV) shall be precisely positioned by solid vane linkages connected to an externally mounted electric PRV actuator.
4. Compressor shall have a close grain cast-iron casing.
5. Impeller shall be fully shrouded and made of high strength, cast aluminum-alloy.
6. The impeller shall be statically and dynamically balanced.
7. Insert type journal and thrust bearing constructed of aluminum alloy shall be provided.
8. The shaft seal shall be provided with a double bellows ceramic seal.
9. Compressor assembly shall be overspeed tested at the factory at minimum of 120% of the design impeller shaft speed.
10. Balance and align motor-compressor assembly to a maximum vibration amplitude of 1 mil as measured at the shaft.
11. Factory alignment and vibration reports shall be completed and submitted to the Designer.
12. Chiller shall be able to unload down to 25% at constant entering condenser water (85°F) without going into surge.

G. Motors:

1. Shall be premium efficiency, open drip-proof or hermetically sealed, non-reversing squirrel cage, induction suitable for the voltage shown on the equipment schedule and operation with the unit mounted variable speed drive. Full load operation of the motor shall not exceed nameplate rating.
2. Open motors shall be provided with a NEMA D-flange configuration for open motors. Bolted cast iron adapter shall be provided to allow the motor to be rigidly coupled to the compressor, providing factory alignment of motor and compressor shafts, and to allow access to the motor for repair without removing refrigerant charge from the chiller.
3. Hermetically sealed motors shall premium efficiency, squirrel cage, induction. The motor shall be rigidly coupled to the compressor, providing factory alignment of motor and compressor shafts.
4. Furnish motors with insulated bearings as required to prevent bearing to shaft current.
5. Chillers utilizing open motors shall be provided with an oil reclaim basin. Shaft seal shall be double face bellows type or floating carbon ring, oil film type. Maximum oil and refrigerant leakage rate of the shaft seals shall be less than 25 fluid ounces of oil per 1,000 hours of chiller operation and less than 5 fluid ounces of refrigerant per 1,000 hours of chiller operation.

6. General:
    a. Motor shall meet the following requirements:
        1) Service factor - 1.04 (minimum)
        2) Locked rotor torque - 60 percent of full load torque
        3) Pull-up torque - 60 percent of full load torque
        4) Breakdown torque - 175 percent of full load torque
        5) Hot locked-rotor damage time - 125 percent of calculated acceleration time.
        6) Minimum efficiency – 96%
    b. Motor shall operate successfully at rated load, with rated frequency and +10 percent of rated voltage.
    c. Motor shall operate successfully at rated load, with rated voltage and +5 percent of rated frequency.
    d. Motor shall operate successfully at rated load with +10 percent combined variation of voltage and frequency, frequency variation not to exceed +5 percent.
7. Enclosure (Open Motors):
    a. Motor enclosure shall be open drip-proof guarded type of cast iron frame and bracket construction with welded steel top cover if required. 360 degrees concentric rabbet fits shall be utilized without dowels for bracket to frame alignment. Provide lifting lugs with a 5x safety margin.
    b. Provide acoustical motor enclosure as required to meet the noise criteria specified later in this section.

c. Provide oversized conduit box and appropriate termination kit to allow for connection of feeder cables of the size shown on the “E” series drawings with ground to motor leads.

8. Enclosure (Hermetically Sealed)
    a. Motor enclosure shall be hermetically sealed of cast iron frame and bracket construction. Provide lifting lugs with a five times (5x) safety margin.
    b. Provide oversized conduit box and appropriate termination kit to allow for connection of feeder cables with ground to motor leads.
9. Stator:
    a. Laminations shall be high permeability, low loss silicone steel with C7 core plate.
    b. Magnet wire is enamel film rectangular copper wire.
    c. Insulation shall be rated Class H components with 800°C temp rise at 1.0 service factor when ambient temperature is 400°C.
    d. Stator winding slot material shall be Nomex type as a minimum.
    e. Stator coils shall individually receive surge comparison testing per IEEE 522 after insulation and prior to insertion of coils into each stator. In addition, surge testing is required prior to final connection of each coil after all are inserted, and on the final fully connected stator, before VPI processing.
    f. Sealed wound stators shall be provided in conformance to NEMA MG1-20.49.
    g. Stator processing shall utilize 100% solids epoxy resin with a minimum of two VPI/baking cycles (both sides). Stators shall not be processed while in the motor frame.
    h. Every complete, finished wound stator shall receive and pass the water submersion test per NEMA MG1-20.49.1. A certified report shall be provided for each submersion test.
10. Rotor/Shaft:
    a. Rotors shall be copper bars.
    b. Rotor laminations shall be manufactured and tested the same as described for stator laminations.
    c. Rotors shall be keyed to the motor shaft and utilize an interference fit to the shaft.
    d. Shafts shall be designed to carry 4x rated torque.
    e. The rotor/shaft assembly shall be dynamically balanced.
11. Bearings
    a. Conventional or Magnetic bearings are acceptable.
    b. Conventional Type Bearings:
        1) Sleeve bearings shall be split type and have SAE 12 high tin content Babbitt in a SAE 40 bronze backed shell. Iron or steel backed sleeve bearing shells are not acceptable.
        2) Sleeve bearings shall have their oil sump cast as an integral part of the end shield/bracket.

3) Sleeve bearings shall utilize solid oil rings for self lubrication, and shall be provided with a means of visually observing oil rings during operation. Two oil rings shall be supplied, both with trapezoidal cross section.

4) The bearing caps shall be removable, such that the bearings may be inspected and replaced without disturbing the compressor/motor coupling.

5) An oil level sight gauge shall be supplied to monitor oil level.

6) Insulated bearings shall be provided where required. A minimum of one in the opposite drive and on anti-friction bearings, two (each end) on sleeve bearings. Insulation shall be located on the bearing shell. Insulated capsules are not acceptable.

7) Motor oil shall be synthetic turbine oil with rust and oxidation inhibitors with a viscosity of 150-180 SSU at 100°F (37.8°C) (ISO-VG-32). Viscosity index shall not be less than 95.

c. Magnetic Type Bearings:

1) Levitated shaft shall be actively controlled and monitored by an X-, Y-, and Z-axis digital position sensor.

2) The compressor shall be capable of coming to a controlled, safe stop in the event of a power failure by utilizing integral backup power to the magnetic bearing control system.

12. Accessories:

a. Provide oversized conduit box and appropriate termination kit to allow for connection of feeder cables with ground to motor leads.

b. Winding Temperature Sensors:

1) Provide winding temperature sensing devices and wire to the chiller starter control module for safety interlocks.

2) Six elements, two in each phase, are to be embedded in the calculated hottest portion of the stator winding. All leads are to be brought out to terminals in auxiliary terminal box. Each lead and each terminal shall be clearly and individually identified. All elements shall be grounded in terminal box.

3) Sensors are to be resistance thermometer (RTD) elements, platinum wire, 100 ohms, at 0°C, 3 lead type with stainless steel armor shielding for use with General Electric "IRT" or Westinghouse "CT" or "DT3" thermal relays.

4) Motor Manufacturer is to recommend trip setting for thermal relays.

5) Provide drawings showing the location and number of each sensing element in the stator winding.

c. Bearing Temperature Sensors:

1) Provide a minimum of one bearing temperature sensor for each bearing and wire to the chiller starter control module for safety interlocks.

2) Sensors shall be installed in bottom half of bearing, preferably within 10 to 20 degrees of the operating load point and drilled so that the sensor is separated from babbitt by 30 +5 mils of metal backing. Sensor leads shall be adequately protected against oil and mechanical damage and exit the bearing housing through an oil-tight fitting. Weatherproof terminal head with moisture-resistant terminals shall be provided outside the bearing housing. Sensor sheath or raceway shall not bypass the bearing insulation. Guides shall be provided so that the sensor may be removed and reinstalled without disassembling the bearing housing or disturbing the wiring system. Means shall be provided for spring loading the sensor tip against the bearing backing.

3) RTDs shall be platinum wire, 100 ohms, at 0°C, tip sensitive-probe type, three wire, with stainless steel armor shielding.

d. Accessory Terminal Boxes:

1) Box(es) shall be provided for leads from stator-temperature devices and bearing-temperature devices.

2) Box(es) shall be weatherproofed and gasketed with bolt on removable covers in front. Box(es) shall be outside motor enclosure or accessible by removing a gasketed subpanel on enclosure.

3) Box(es) shall be suitable for conduit entry through top or bottom.

4) Terminal points shall be furnished in the box(es) for all wiring. Terminal points shall be clearly identified per NEMA standard notation.

5) Permanent nameplates shall be provided on all terminal boxes.

e. Noise Level:

1) Motor noise level shall not exceed 85 dBA measured at one meter from motor enclosure surface in any direction.

2) Motor manufacturer shall correct motor noise levels exceeding the level specified above at no expense to the Owner.

3) Noise tests are to be conducted in accordance with IEEE Standard No. 85.

f. Testing:

1) Routine testing shall meet or exceed NEMA minimum standards.

2) A dynamic three phase locked rotor test shall be performed as part of the routine test.

3) All vibration testing, routine and other, shall be performed on a rigid base, mounted to a seismic mass isolated from the building foundation.

4) Efficiency date shall be in accordance with IEEE Standard 112 Method B as defined by NEMA MG1-12.53a and 1-12.53b.

H. Refrigerant Flow Control:

1. Refrigerant flow to the evaporator shall be controlled by either a variable or fixed orifice. The variable orifice control shall automatically adjust to maintain proper refrigerant level in the condenser and evaporator. This shall be controlled by monitoring refrigerant liquid level in the condenser assuring optimal sub-cooler performance.

I. Capacity Control System:

1. Furnish each unit with fully automatic capacity control system, complete with inlet guide vanes, capable of fully modulating performance down to 15% of full load without surge.
2. Capacity control system to permit stable operation of machine at any point within 15 to 100% capacity range.
3. Control system to include automatic stopping when load falls below 15% and automatic restarting when load rises again to 15%.

J. Lubricating System:

1. Furnish unit with forced feed type lubrication system for proper lubrication of transmission and bearings providing positive supply of oil to all rotating surfaces even during power failure shutdown. System to include oil pump assembly, factory mounted oil pump starter, motor controls, cooler, heater, relief valve, pressure regulator, and filter for delivering thermostatically controlled clean oil at proper temperature.
2. Use chilled water source for cooler if required.

K. Accessories:

1. Purge System:
    a. For low pressure chillers furnish each unit with factory installed, wired, and piped purge system suitable for removing non-condensable gases and water.
    b. Purge system shall operate when chiller is off.
    c. Purge system shall be high efficiency type complete with compressor, coil separator, air, water or refrigerant cooled condenser, purge tank, sight glass and necessary controls, and shall not purge more than 0.02 lbs (9g) of refrigerant per lbs (454g) of air when operating at condensing refrigerant temperature higher than 80ºF (27ºC).
    d. Provide complete with excess purge shutdown with indicating light and alarm relay. Provide purge duration timer and refrigerant moisture indicator.
    e. Provide a totalizer for number of purge starts.
2. Safety Relief Devices:
    a. Provide redundant and re-seatable safety devices in accordance with ANSI B9.1 safety code ASME B31.5 and the latest version of ASHRAE Std. 15 on the evaporator and condenser consisting of rupture discs in series with spring loaded re-seatable relief valves. Provide valved and capped test port inline between rupture disc and relief valve to detect rupture disc failure. Multiple relief devices shall be brought to a common vent connection.
3. Vibration Isolation:
    a. Manufacturer to furnish properly sized 3/4" thick (min.) 50 duromater, neoprene rubber pads to Contractor to install below chiller support feet.

L. Control Panel and Instrumentation:

1. Furnish each unit with control center in locked enclosure, factory mounted and wired. Prior to shipment, controls test shall be executed to check for proper wiring and ensure proper control operation.

2. Control Panel: 10" minimum color display mounted on control panel door or on articulated arm. Color display shall show all system parameters in the English language with numeric data in English units. The chiller control panel shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays, switches and remote equipment including refrigerant leak detection system.
3. Controls shall be microprocessor based for automatic operation, display system parameters, programming of essential set points and failsafe safety control of machine. Controls to include the following:
    a. System pressure display to include evaporator/condenser refrigerant, and lubricating oil pressure.
    b. System temperature display to include return/leaving chilled water, return/leaving condenser water, and evaporator/condenser refrigerant saturation temperature.
    c. Indicators to highlight operation of oil pump and compressor loading/unloading/auto control.
    d. Set point programming to include leaving chilled water temperature, and demand limiting.
    e. Provide battery backup if memory is volatile.
    f. Annunciation of all safety controls indicating cause of shutdown and type of restart required.
    g. One set of dry contacts for remote indication of any safety trip or alarm condition.
    h. Adjustable rate at which chiller is allowed to load.
    i. Capability of manual operation of oil pump, compressor loading and unloading.
    j. Anti-recycle control to ensure safe time intervals between successive compressor motor starts.
    k. Automatic safety shut-down for low evaporator refrigerant temperature or pressure, high condenser refrigerant pressure, low oil pressure, high compressor discharge temperature, high motor winding temperature, motor over current, over voltage, under voltage, power phase reversal, and bearing high temperature. Each of these cutouts shall have manual reset and cause alarm indication.
    l. Provide self-diagnostics, including history for at least previous 10 shutdowns with time/date stamp and description.
    m. Elapsed operating hours and number of starts meter.
    n. Remote chiller start-stop upon input from building management system. Provide one set of dry contacts for remote indication of local-remote control and one set of dry contacts to indicate On/Off status of chiller.
    o. Chilled water supply temperature reset proportionally based on remote 4-20 mA or 0-10 VDC input signal. Provide bypass switch to disable chilled water reset.
    p. Chiller current limit input to limit maximum demand based on remote 4-20 mA or 0-10 VDC input signal in addition to programmed loading rate. Provide bypass switch to disable current limit.

q. Security:
    1) Security access shall be provided to prevent unauthorized change of set points, to allow local or remote control of chiller, and to allow manual operation of the pre-rotation vanes and oil pump. The operating program shall be stored in non-volatile memory (EPROM) to eliminate chiller failure due to AC power failure or battery discharge. Programmed set points shall be retained in lithium battery-backed RTC memory for a minimum of 5 years.

r. Power failure restart: After a power failure and restoration of normal power, chilled water flow and condenser water flow, chiller must be capable of starting and reaching 100% load within 12 minutes or less without experiencing surge or stall.

4. Chiller Control System Interface Translator:
    a. The main chiller control panel shall communicate using the Read (Initiate) and Write Services as defined in Clauses 15.5 and 15.8, respectively, of ASHRAE Standard 135, to communicate Modbus objects to the existing chiller plant control system. No third party device (translator) should be used to interface to the needed control points for proper operation.
    b. The chiller control panel shall be capable of communicating all available information from the chiller mounted control panel including all available operational, safety and informational control points and these points shall be mapped to the DCS unless otherwise indicated by the Owner. Manufacturer shall supply the Modbus object list to the Owner for each chiller for what is accessible to the Modbus internetwork. Coordinate with the Owner to supply the specific points and control to include on the DCS.

5. Integration With Distributed Control System (DCS)
    a. In addition to the Interface Translator Modbus communication link, the chiller microprocessor based control system or chiller starter control panel shall be capable of communicating the following hard wired input/output signals with the DCS:
        1) Chiller start/stop
        2) Chilled Water Supply Temp Setpoint
    b. Chiller status
        1) Chiller fault
        2) Run load amps
    c. If the control system provided with the chiller cannot communicate any of the above hard wired control points with the DCS, an auxiliary lockable, NEMA 1 rated enclosure shall be provided for the communication of these points. The auxiliary control panel shall be factory installed, wired and tested including all required terminal strips, instruments, temperature indicators, relays, signal conditioner/loop isolators, switches and gauges.
    d. Web Connection
        1) Provide IP or Web based control interface that is configured for HTTPS.

2) The Chiller Manufacturer shall coordinate setup of IP devices on Local Area Network parameters with Owner as coordinated by Contractor.
3) Include explanation of any algorithms and learning periods that are required by the OEM controls.
4) Security: Security access shall be provided to prevent unauthorized change of set points, to allow local or remote control of the chiller and to allow manual operation of the pre-rotation vanes and oil pump. Security shall be at least three levels, view only, operator screen, and integration / technician access. See passwords protections in this specification. The operating program shall be stored in non-volatile memory (EPROM) to eliminate chiller failure due to AC power failure or battery discharge. Programmed set points shall be retained in lithium battery-backed RTC memory for a minimum of 5 years.
5) Graphic screens shall provide for:
    a) Chiller overview
    b) Evaporator
    c) Condenser
    d) Compressor/refrigerant circuit
    e) Motor
    f) Capacity control diagram
    g) Manual/Auto stations for all control outputs
    h) Approaches
    i) Power
    j) Key timers
    k) Alarms, alarm history
6) The operator web interface shall provide display of all major operating parameters in both graphical and list type screen displays. The graphics shall mimic the standard graphics on the chiller control panel. PID control loop set points and Manual/Auto functions shall be accomplished by the operator web interface as well as through the Owners DCS control system. Alarm indicators on the graphic display screen shall provide annunciation and an alarm history screen to which show the most recent alarms, with the time and date of occurrence. Trip status screens shall be provided which show the values of all analog inputs at the time of the last 128 chiller safety shutdowns. The time and date of each shutdown should also be shown.

M. Interlocking and Control Sequence:
1. Unit manufacturer shall carefully coordinate unit controls with automatic control sequence requirements and provide all necessary auxiliary contacts and integral wiring required to meet these functions.
2. Chilled water pumps and condenser water pumps shall be in operation and flow proven before refrigeration machine automatic control sequence is initiated.

3. Provide condenser and evaporator proof of flow switches or differential pressure transmitters required for chiller start-up and operation. Switches or transmitters shall be either mounted on chiller or remote in system piping and interconnected with the chiller control panel as required by manufacturer.

N. Acoustic Performance:

1. Chiller Sound Pressure Level (SPL) at approximately 3 ft (1 m) from machine and at height of approximately 5 ft (1.5 m) above floor when measured in accordance with AHRI Standard 575-94 or the latest edition, shall be noted by manufacturer on Bid form, but shall not exceed the following:

	SPL at 25-30% of Full Load							
	in db re: 2 x 10-5 N/m2							
Freq. (hz)	63	125	250	500	1000	2000	4000	8000
	84	86	86	86	87	85	78	78

2. If chiller noise generation exceeds these levels, the Manufacturer shall provide acoustical devices and treatments with the chiller to reduce the noise generation to the level specified.

O. Painting

1. Chiller shall be provided with a factory applied prime coat plus two coats of finish paint.
2. All exposed surfaces and insulation shall be primed and painted with an alkyd-modified, vinyl enamel or acrylic, machinery primer and paint system.
3. Finish paint color shall be the manufacturer's standard.
4. One (1) quart of finish paint shall be provided with each chiller.

P. Insulation:

1. Refer to Part 4 of this specification.

Q. Factory Performance Tests:

1. All factory controls shall be tested for functionality.
2. Refer to Part 3 of this specification for performance test requirements.

2.2 UNIT MOUNTED VARIABLE FREQUENCY DRIVE (VFD)

A. GENERAL

1. Provide a VFD system to control each chiller compressor. All equipment and devices shall be provided for a complete and operational system in an integrated package, factory tested with the chiller and motor. The VFDs shall be provided by the Manufacturer as a coordinated system.
2. Each Chiller shall have a single input cabinet. The input cabinet shall be arranged to accept a single 480V, 3 phase circuit per VFD/chiller compressor, two 480V, 3 phase circuits in total.
3. Each VFD shall have input impedance equivalent to a 5% line reactor.

4. Provide VFD designed to meet IEEE 519 harmonic distortion requirements. It shall be the responsibility of the Chiller manufacturer to design the VFD and provide all components required to meeting this power quality standard.
5. Each VFD cabinet shall include CTs, PTs, any required power quality components, and step-down transformers to accommodate all auxiliary 480V, 120V, and LV loads at the VFD and at the chiller.
6. The VFD shall be provided with integrated refrigerant based, chilled water based, or air based cooling system. All cooling system refrigerant or chilled water piping shall be provided by the unit manufacturer. No additional power or other utilities shall be necessary for the cooling system. The chilled water based system shall include all necessary pumps, piping, mixing valves, heat exchangers, insulation, and specialties. Chilled water source shall originate from the chiller heads, marine water, boxes, etc. as applicable. The chiller shall be sized to accommodate the chilled water requirements for VFD cooling while maintaining the zero tolerance tonnage to the Owner.
7. The VFD control logic shall be specifically designed to interface with the chiller controls. The VFD control shall adapt to the operating ranges and specific characteristics of the chiller, and chiller efficiency is optimized by coordinating compressor motor speed and compressor inlet guide vane position. Chilled water control and VFD control shall work together to maintain the chilled water set point, improve efficiency and avoid surge.

B. QUALITY ASSURANCE

1. Provide equipment in full accordance with the latest applicable rules, regulations and reference standards, including but not limited to:
    a. NEMA Listed - ISC-6, ISC-7
    b. ANSI - Instrument Transformers C57.13
    c. CSA - Industrial Control Equipment C22.2 No 14
    d. IEEE 1100 AND IEEE 519 – 2022
    e. NFPA 70, National Electric Code - latest edition
    f. System registered to ISO 9001
2. All fully assembled controls shall be combined-tested for performance and functionality at the manufacturer's factory with fully loaded VFD rated induction motors. The combined test data shall then be analyzed to insure adherence to quality assurance specifications.

C. ELECTRICAL NOISE CRITERIA

1. Voltage and current distortion generated by VFD and attenuation devices shall not exceed the following criteria as referenced by IEEE Standard 519:
    a. Total harmonic distortion (THD) shall not exceed 8% RMS of fundamental input voltage at full load with maximum 5% RMS on any single harmonic.
    b. Total harmonic current demand distortion (TDD) shall not exceed 5% in amplitude of fundamental input current.

D. DESIGN AND FABRICATION

1. Voltage:

a. Each VFD shall accept single-point connection from nominal plant power of 480 volts.
b. The supply input voltage tolerance shall be +/-10% of nominal line voltage.

2. Current:
   a. Each VFD has a "normal duty" rating of 100% continuous current with a short time duty rating of 110% overload for one minute, once every 10 minutes or continuous operation at 104%.
3. Frequency:
   a. The drive system shall provide controlled speed over the range from 38 to 60 Hz.
4. Power Factor:
   a. Each VFD shall be capable of maintaining a minimum displacement power factor of 0.99 at all loads.
5. Efficiency:
   a. VFD efficiency shall be a minimum of 97%.
6. Environmental Ratings:
   a. Storage ambient temperature range -40°F (-40°C) to 158°F (70°C)
   b. Operating ambient temperature range 32°F(0°C) to 104°F (40°C)
   c. The relative humidity range is 0% to 95% non-condensing
   d. Operating elevation: up to 3,300 ft (1000m) without derating.
7. Audible Noise:
   a. The maximum audible noise from the VFD shall comply with OSHA Standard 3074, Hearing Conservation, which limits noise level to 85 dBA.
8. Motor Compatibility:
   a. The VFD shall be capable of operating the chiller motor over the speed range specified. Drives which require motors with higher insulation values will not be acceptable. The VFD drive shall provide near sinusoidal voltage and current waveforms to the motor at all speeds and loads. VFD induced torque pulsations to the output shaft of the chiller shall be less than 1% to minimize the possibility of exciting a resonance.
   b. The motor insulation system shall not be compromised thermally or due to dv/dt stress. Dv/dt at the motor terminals (line-to-line) shall be limited to 10 volts per microsecond. If dv/dt at the motor terminals (line-to-line) exceeds 10 volts per microsecond, the vendor must state the actual value in the attached data sheets and include steps taken to guarantee the long term life of the motor insulation system.

c. The VFD shall be designed for a maximum availability of 99.9%. The VFD shall be designed for a mean time between failure (MTBF) of 100,000 hours. The VFD shall be designed for a minimum life expectancy of 20 years, based on 5,000 hrs of operation per year. The VFD shall have a control power monitoring system that monitors all power supply voltages and signals Power switch device diagnostics shall detect and protect against device short, over and under gate voltage, loss of gating, loss of diagnostic feedback, heat sink temperature feedback as well as overload monitoring and protection. Failed power switch components shall be replaceable without the removal of the entire power module. Special tools or force measuring transducers shall not be required.

9. Control Logic:
    a. The VFD shall be capable of operating with the output short circuited at full current. The drive system shall provide controlled speed over the range from 38 to 60 hz. Speed accuracy within this range, expressed as a percent of top speed, shall be within 0.5% of base speed without encoder or pulse tachometer feedback (0.1% with encoder or pulse tachometer feedback). The VFD shall have a " normal duty " rating of 100% continuous current with a short-time duty rating of 110% overload for one minute, once every 10 minutes (suitable for variable torque loads).
10. Auto Tuning:
    a. The VFD, in conjunction with the chiller controller shall have an auto tuning function which includes optimizing the chillers system energy efficiency.
11. Starting Mode:
    a. The VFD shall offer two starting modes. The S-curve profile shall consist of both non-linear and linear portions. The Ramp mode shall be programmable with four ramp speed break points.
12. Auto-Restart Capability with the Chiller:
    a. The VFD in conjunction with the chiller controller shall be capable of automatically restarting in the event of a momentary power loss, or a clearing of a VFD auto-restart trip.
13. Protective Features:
    a. Fault information shall be accessible through the VFD human interface. The VFD shall have comprehensive protective diagnostics for line side, VFD system, and load side.
    b. Kirk key for interlocking the system which prevents unsafe access to doors.
    c. Output line-to-line and line-to-ground short circuit protection shall be provided.
    d. Input protection shall be provided via surge arrestors.
14. Enclosure:
    a. VFD enclosure shall be NEMA 1G (IP21). Door latches shall be heavy-duty 1/4 turn type units which are operated with an Allen wrench. The VFD shall be designed for front access to allow for installation with no rear access. Equipment that requires rear access shall not be accepted.

b. The VFD shall be designed for top entry line power (via optional tophat if required) and back load power exit directly to the motor. The power cable connections are bolted type. Lugs shall be provided. Use copper conductors only for terminal connections.

15. Structural Finish:
    a. All VFD exterior metal parts shall be painted with hybrid epoxy powder paint. Any “Tophat” raceway provided by the Contractor for cable transition from conduit into the VFD shall be painted to match the VFD for consistency.
16. Power Bus:
    a. All power bus bars, when part of the standard design and other current carrying parts shall be high-conductivity, low loss copper with nickel or tin plating for corrosion resistance. Power bus bar joints shall be nickel or tin plated.
17. Disconnects:
    a. The VFD shall include a main disconnect device (molded case thermal magnetic circuit breaker rated 65KAIC with shunt trip option) with an interlocked and pad lockable handle mechanism.
    b. When multiple doors are supplied, all doors shall be electrically interlocked with the disconnect device. The interlocks shall include provisions to manually override for test and repair.
18. Protection and Metering Equipment:
    a. Provide a microprocessor based motor protective relay for protection, control and monitoring of each motor. Basis of Design: Allen Bradley 825P.
    b. Relay(s) shall monitor remote resistance temperature detection (RTD) modules for measurement of motor windings and bearing temperatures if not provided in chiller control panel. Chiller shall be furnished complete with interconnecting wiring for these points from motor to protective relay control panels.
    c. Provide relay protection and metering capabilities. Relay(s) shall provide the following protective functions:
        1) Undervoltage
        2) Lock rotor current (overcurrent)
        3) Instantaneous overcurrent
        4) Undercurrent
        5) Phase loss
        6) Phase unbalance
        7) Phase reversal
        8) Unbalance/ negative sequence
        9) Zero sequence ground fault with run and start time delay
        10) Mechanical jam/stall
        11) Thermal trip
        12) Custom overload curve
        13) Stator winding over-temperature (6 inputs)
        14) Motor bearing over-temperature (2 inputs)

15) Relay(s) shall provide the following control functions:
16) Incomplete sequence delay
17) Antiback spin timer
18) Relay(s) shall provide a digital display of the following measured parameters:
19) Three phase average current
20) Individual phase currents
21) % of full load current
22) Individual winding temperatures
23) Individual bearing temperatures
24) Phase to phase voltage
25) Number of starts
26) Provide metering to indicate the following:
27) Motor current as percent of full load amperes
28) Run time (hours)
29) Total KWH/incoming
30) Instantaneous KW complete with 4-20 ma output
31) Instantaneous motor KW complete with 4-20 ma output

d. Current transformers used for overload protection shall be of linear response through six times full load motor current and shall have adequate burden capacity for devices they supply. Linear response shall be per ANSI accuracy classification.
e. All control, protection and metering equipment shall be mounted in separate isolated low voltage compartment.

19. Operator Interface:
    a. The VFD shall have a user-friendly operator interface integrated into the chiller control panel. The following values shall be indicated locally and remotely at the BAS:
        1) Output speed in hertz and rpm
        2) Input line Volts, Amps, Hz, KW, KVA, PF
        3) Output line Volts, Amps, Hz, KW, KVA, PF
        4) Average current in % RLA
        5) Internal VFD temperature and cooling unit controls.
        6) All relay and other protective settings. They shall be adjustable from the control panel.
        7) Fault and alarm summary
20. Communications:
    a. The VFD shall be provided with a digital communication capability to allow for direct control and full comprehensive communications, including diagnostics, with the chiller controller and the plant control system.

21. Spare parts:
    a. Provide manufacturer's recommended complete spare parts kit and address of local supplier stocking location. Spare parts shall be labeled with name and part number. Spare parts shall be stored on-site.

2.3 REFRIGERANT PUMPOUT SYSTEM:

A. Provide a fixed, free-standing, refrigerant pumpout system with the chillers.

B. The packaged skid system shall include refrigerant compressor and drive with oil separator, heater, water cooled condenser, filter drier, safety relief devices, skid piping, required isolation valves, and controls to allow for complete removal, storage, and return of the entire refrigerant charge to each chiller through Contractor installed piping.

C. Water cooled condenser shall be suitable for operation utilizing 60°F domestic water or 85°F condenser water and shall be constructed for working pressures to 150 psig and test pressures to 225 psig. Air cooled condensers or combination air cooled/water cooled condensers are not allowed.

D. Maximum skid size shall be: 4'-0W x 8'-0"L x 6'-0"H.

E. Power connection including compressor motor shall be suitable for 480 volt, 3 phase, 60 hertz power.

F. Vertical storage vessel construction to meet ASME code and shall be provided with a full range water column type sight glass for monitoring level and re-seatable safety devices in accordance with latest edition of the Mechanical Refrigeration Safety Code, ANSI/ASHRAE 15, consisting of a stainless steel rupture disc upstream and in series with re-seatable relief valve(s).

G. Vessel shall be constructed for the same pressure ratings as refrigerant side of unit and sized with sufficient capacity to hold one pair of series-counterflow chiller's refrigerant charge (totaling 2,500T) 80% full at 90˚F.

H. Provide a valved and capped test port between each rupture disk and associated relief valve(s) and plugged tee for connection of portable purge unit that will be used to vent non-condensables from the tank.

I. Maximum vertical storage tank size shall be: 4'-0" diameter, 10'-0"H to top of the tank including all related appurtenances.

J. Storage tank base shall configured with feet to allow for mounting on four (4) digital weight scales provided by the Contractor that will provide for measurement of the weight of the refrigerant stored.

PART 3 – EXECUTION – BY EQUIPMENT MANUFACTURER

3.1 CHILLER FACTORY TESTING

A. Manufacturer shall conduct factory performance witness test for one pair of the series counterflow chiller pairs for BCP. Certified performance test reports shall be provided for the four remaining chillers prior to shipment, with ability to witness virtually available.

B. Notify Owner and Designer two (2) weeks in advance of factory performance test so that representatives of the Owner and Designer may witness test. Manufacturer shall be responsible for the costs of providing transportation and accommodations for two (2) representatives of the Owner and one (1) representative of the Designer. If a retest is required at a later date, the Owner and Designer shall witness the retest. Manufacturer shall be responsible for the cost of the transportation and accommodations of the Owner and Designer to witness the factory performance retest.

C. Factory performance test shall be in accordance with AHRI 550/590 test procedures, except as modified below, to verify design capacity and part load capacity points indicated on the Bid Summary Data Sheet included in Part 5 of this section.

1. Conduct test at an approved AHRI certified test facility of the Manufacturer. Owner/Designer may elect to contact AHRI for verification of performance and test conditions.
2. Instrumentation used for testing must be calibrated within six (6) months of the test date and traceable to the National Bureau of Standards. All documentation verifying NBS traceability shall be included in a bound folder for presentation to the Owner/Designer.
3. Test chiller with water temperature and adjustment cooler/condenser per standard AHRI 550/590 to simulate specified fouling versus no fouling during test. Verification of this procedure will require inside surface area and number of tubes per vessel. This information is to be submitted with proposal for formula verification of fouling per AHRI 550/590.
    a. A downward temperature adjustment per AHRI 550/590 shall be made to the design leaving evaporator water temperature to adjust from the design fouling to the clean tube condition.
    b. An upward temperature adjustment per AHRI 550/590 shall be made to the design entering condenser water temperature to adjust from the design fouling to the clean tube condition.
    c. There shall be no exceptions to conducting the performance test with clean tubes and with temperature adjustments in (1) and (2). The manufacturer shall clean tubes, if necessary, prior to test to obtain a test fouling factor of 0.0000.

D. Modifications to AHRI Standard shall be as follows:

1. Chiller tonnage shall be equal to or greater than specified value when producing water at project required conditions (no tolerance allowed).
2. Chiller energy consumption (kW) shall not exceed value submitted on the Chiller Bid Summary Data Sheet or energy consumption penalty will be imposed (no tolerance allowed).

3. All design conditions, part load performance data and full load performance data is to be evaluated with 480 volt, three phase, 60 hertz power supplied to chiller VFD.
4. The performance test shall be a four-point test per chiller. Points to be tested will be selected at time of test.
    a. One test point will be at full load and full lift conditions.
    b. The other three points will be part load points selected by Owner from the Chiller Bid Summary Data Sheet submitted with the bid.

E. During the test, all machinery performance data including, but not limited to, oil pressures, gas pressures, and component temperatures shall be recorded at fifteen (15) minute intervals and compared to standard conditions supplied by the manufacturer. If at any time during the test, the recorded machinery performance data is in excess of the standard conditions, the test will be considered not valid and the test shall be restarted for and additional period.

F. Defective work or material shall be replaced or repaired, as necessary, and inspection and test repeated. Repairs shall be made with new materials. Tests for various items of equipment shall be as specified in their respective specification sections. Defective work includes the following:
1. Compressor VFD kW input in no case shall exceed that indicated in these specifications for full load conditions (no AHRI tolerance allowed). Capacity must meet or exceed tonnage indicated on the Chiller Bid Summary Data Sheet. In other words, there is zero tolerance allowed on both efficiency and capacity.
    a. If chiller assembly fails to meet full load capacity, the Manufacturer will be allowed to adjust and retest the machine. If the Manufacturer cannot successfully pass the full load test, the Owner can either reject the machine or accept the machine as is and assess a penalty charge as described herein.
2. If an unacceptable performance test is determined by the Designer or Owner, additional subsequent test(s) may be required at the discretion of the Owner. The complete cost of the additional test(s) requested or caused by equipment operation condition exceeding standard conditions or not meeting the overall operating efficiency, shall be borne by the Manufacturer.
3. Penalties for not meeting performance data as shown on the Chiller Bid Summary Data Sheet shall be as follows:
    a. If a chiller fails to meet full load capacity, Owner may elect not to accept delivery until chiller is modified at Manufacturer's expense to meet design capacity or to assess penalty charge of $5,000 per ton (pro-rated per fraction of a ton) that chiller capacity falls short of full load capacity. If Manufacturer elects to modify the chiller a retest of the chiller will be required.
    b. If a chiller fails to meet any of part load performance data supplied by Manufacturer with the bid, Owner may elect not to accept delivery until chiller is modified at Manufacturer's expense to meet all points of design and part load performance data or to assess penalty charge equal to twenty-five (25) years operating cost differential. This differential is to be determined by using 4-point part load data included in bid form and data obtained from performance test, subtracting bid data annual operating cost from test data annual operating cost, and multiplying by annual load, average electricity cost, and 25-year present value factor noted below.

c. All bids will be analyzed on a 25-year present value basis using the run hours noted below:
    1) All chillers will be offline 3.8% of the year
    2) Zero annual load increase
    3) Average electricity cost of $0.08/kWh
    4) 25-year Present Value Factor for Industrial Electricity of 19.46 from NISTIR Table Ba-3

G. A certified test report of all data shall be submitted to the Owner and Designer prior to shipment. The factory certified test report shall be signed by an officer of the manufacturer's company. Preprinted certification will not be acceptable; certification shall be in the original.

H. After completion of Factory Performance Tests, the chillers shall be flushed with clean water, drained, and dried in preparation for shipment to prevent any surface corrosion on normally wetted surfaces.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Assembled chiller or all major components (compressor, evaporator, condenser, and intercooler) to be factory leak tested evacuated and protectively charged with nitrogen before shipment by the Manufacturer.

B. Each unit shall include initial charge of refrigerant shipped separately by bulk tank delivery, initial charge of compressor and driveline component oil shipped separately.

C. Any sensor or other device protruding from the equipment shall be protected from normal shipping hazards by the Manufacturer.

D. Secure all component connections to protect mating surfaces and keep out foreign materials.

E. The Manufacturer shall shrink wrap each entire unit with an environmentally recyclable material standard. The material shall include an imbedded desiccant to minimize/eliminate internal moisture.

F. Units shall be shipped by the Manufacturer with attached metal plates that indicate name of manufacturer, chiller model number, compressor type, refrigerant type and quantity.

G. Upon delivery, Manufacturer shall Advise the Contractor in regard to proper rigging methods and reassemble the chiller inside the plant as required, and perform a leak test matching factory requirements. Once leak test is complete, the Manufacturer shall evacuate the chiller and protectively charge the chiller with nitrogen until it is ready to be charged and put into service.

3.3 INSTALLATION / START-UP:

A. Intent is to provide for equipment that meets all functional and applicable code requirements. This includes but is not limited to all electrical, controls (including the Owner's plant control system), piping, drains, vents and mounting. This manufacturer shall be responsible for coordinating all such requirements of units provided under this specification with the Contractor and the Owner. Any additional installation or redesign costs associated with the installation of the equipment provided that is different than that illustrated on the submitted shop drawings shall be the responsibility of the equipment manufacturer.

B. A factory-trained service representative of the manufacturer shall supervise the field-assembly (if any), final installation, pressure testing, checkout, start-up, adjusting and balancing of the chiller. Prepare and submit manufacturer's written report/log of the installation and start-up signed by the service representative and the Owner. The Manufacturer's Representative shall supervise leak testing, evacuation, dehydration, and charging of oil and refrigerant. If the chiller is found to have lost its shipping pressure prior to the time of installation, then the machine shall be leak tested, and shall be evacuated a minimum of 24 hours. Other special provisions for unit testing and setups as recommended by the equipment manufacturer in operations and maintenance manuals shall also be followed. The Manufacturer shall provide 40 hours of time for each chiller.

C. Before acceptance by Owner/Designer, unit manufacturer shall approve, in writing, the complete installation, including piping and wiring connections, and proper functioning of all operational and protective/safety controls.

3.4 FIELD TESTING:

A. Pressure Test: The Manufacturer shall conduct a standing pressure test on the refrigerant circuit for a period of 12 hours using nitrogen with exceeding test pressure recommended by the manufacturer in operations and maintenance manuals. Conduct a standing vacuum test on the vessel equal to 1 mm Hg absolute for a 24-hour period. Machine shipped pre-charged need not comply with this requirement unless the factory pre-charge or holding charge is lost during shipment or prior to start-up, in which case, the Manufacturer shall test as indicated. Perform all test and start-up in such a manner as not to introduce moisture into the machine.

3.5 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. Up to two separate courses shall be provided, one for equipment fundamentals, one for the chiller and associated VFD/ASD, and the refrigerant pump out system.

C. The fundamentals course shall include:
   1. Start-up, check-out and routine maintenance

2. Refrigeration cycle
3. Lubrication cycle
4. Electrical control sequence and trouble shooting.

D. The fundamentals course shall include a minimum of 8 hours of general training plus six (6) technical sessions (bi-monthly) not less than 4 hours in length or more than 8 hours in length. These sessions shall cover the most appropriate operation and maintenance issues for the given season and provide technicians an opportunity to ask and discuss issues from their experiences in operating and maintaining the chiller.

E. The fundamentals course shall be conducted at the Owner's facility for up to six (6) of the Owner's maintenance personnel. Instruction time periods shall be approved by the Owner and conducted during normal working hours of 8:00 AM to 4:30 PM Monday through Friday. Instruction shall be a combination of classroom instruction and hands-on training.

F. The chiller, variable frequency drive, and refrigerant pump out system course shall include a minimum of 8 hours of training time. The chiller variable frequency drive manufacturers shall provide training for the complete operation and maintenance of the variable frequency drive and protection/control modules. This includes, but is not limited to, how to use the equipment for troubleshooting, real time and historic features, terminology definitions, adjustments and settings, etc.

G. The chiller and variable frequency drive course shall be conducted at the Owner's facility for up to six (6) of the Owner's maintenance personnel.

H. 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.

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

J. 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.

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

3.6 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.

PART 4 – EXECUTION – BY INSTALLING CONTRACTOR

4.1 DELIVERY, STORAGE, AND HANDLING

A. Contractor to coordinate and expedite delivery of equipment to the project site with the manufacturer and provide unloading and rigging of equipment into place as part of setting/installation process as recommended or required by the manufacturer.

B. Units will be stored and handled in accordance with Manufacturer's instructions by the Contractor.

C. Contractor will protect chiller and controls from physical damage and Contractor will leave factory shipping covers in place until installation.

4.2 INSTALLATION

A. Receiving, rigging and setting of chillers and associated refrigerant pump out unit including coordination of exact delivery date with Manufacturer.

B. Install equipment as shown on drawings, and in accordance with manufacturer's installation instructions.

C. Provide concrete housekeeping pads/curbs and install rubber isolation pads provided by equipment manufacturer under chiller support feet.

D. Extend chilled water, condenser water, any auxiliary water, and refrigerant pump out system piping as required by the equipment and insulate each as specified.

E. Pipe refrigerant relief devices and any purge unit vents to building exterior. Discharge pipes shall not be less than relief device outlet size. Discharge from more than one relief device or purge unit per refrigeration machine may be combined into a common header, provided cross-sectional area of common header is at least sum of the cross-sectional areas of the connected pipes. When length of discharge piping exceeds 50 feet, piping shall be increased one pipe size.

F. Piping connections shall not create stress on chiller flanges and nozzles. After final connections are completed, remove bolts from flanged connections at chillers. Piping shall remain aligned after bolts have been removed, or if bolts cannot be removed by hand, revise piping to align piping with chiller connection. Piping/chiller alignment verification shall be completed in the presence of the Owner’s representative. If after completion of the strain-free verification of the piping system must be disassembled at any point in the system, the strain-free verification shall be repeated.

G. Install control devices, raceway systems and/or wiring between the chillers and VFD’s and the Owners control system.

H. Extend electrical service to the chillers including feeders to the VFD’s, motors and associated auxiliary devices.

I. Touch up paint on the entire chiller prior to applying insulation.

J. Install necessary piping with insulation for lubricating system cooler if required.

K. All chiller surfaces below 65°F when the chiller is operation shall be insulated by the Contractor after all piping connections are made to eliminate any condensation from forming and dripping on the plant floor. This includes, but is not limited to the evaporator shell, water boxes, cover plates, suction elbow, vent and drain connections, etc. Water piping and connections shall also be insulated by the Contractor.

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

M. 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.

N. 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 CHILLER BID SUMMARY DATA SHEET

A. Complete and submit the following form **with Bid** submittal. Provide separate form if submitting voluntary alternatives.

100% Design Data	**Specified Value**	**Input Bid Value**
Manufacturer	-	
Model No.	-	
Refrigerant	R-513A, R-514A or R-1233zd(E)	
Total Capacity Per Series-Counterflow Chiller Pair	2,500 Tons	
Voltage AC	480	
Phase	3	
Evaporator Data Per Chiller		
Flow (GPM)	4,275	
Entering Water Temperature of Chiller Pair	56˚F	
Leaving Water Temperature of Chiller Pair	42˚F	
Fouling Factor	0.0001	
Total Maximum Pressure Drop for Both Chillers in Series-Counterflow Arrangement (Feet)	22	
Condenser Data Per Chiller		
Flow (GPM)	7,500	
Entering Water Temperature of Chiller Pair	85˚F	
Leaving Water Temperature of Chiller Pair	95˚F	
Fouling Factor	0.00025	
Total Maximum Pressure Drop for Both Chillers in Series-Counterflow Arrangement (Feet)	22	
Electrical Data Per Chiller		
Max. Power Input (Kw)	-	
LRA (LH)	-	
RLA (LH)	-	
LRA (RH)	-	
RLA (RH)	-	

B. Complete the table below by inputting kW/Ton (zero tolerance on kW and tonnage) values for each operating condition. Data provided will be utilized for factory chiller performance test verification and bid evaluation.

1. The leaving evaporator water temperature shall be held constant at 42°F.
2. The evaporator water and condenser water flow rates shall be held constant as scheduled above.
3. If condition listed below is not possible due to turndown or maximum capacity of the chiller, identify with “N/A” in table.

Percent Load	85˚F ECWT	75˚F ECWT	65˚F ECWT	55˚F ECWT
100				
90				
85				
80				
75				
70				
60				
50				
40				
30				
20				
Minimum = ____%				

5.2 LIFE CYCLE COST ANALYSIS FORM

A. Complete and submit the following form **with Bid** submittal. Provide separate form if submitting voluntary alternatives.

NC SCO LCCA Form - CHILLERS 200 TONS AND LARGER	
Project Owner:	University of North Carolina
Project Title:	Chilled Water Infrastructure Expansion - BCP
Project ID#:	22-25588-02H

Design Data			
Load %	Load (Tons)	Hours Per Year	Ent. Cond. Wtr. Temp (°F)
100	2,500	500	85.0
85	2,125	2,000	75.0
80	2,000	1,500	65.0
75	1,875	1,000	55.0

Manufacturer Data - Input Specified "Zero Tolerance" Data for Tonnage and kW				
Manufacturer Name	Carrier	Daikin	Trane	York
Model Number				
Load Per Tons @ 100%				
Load Per Tons @ 85%				
Load Per Tons @ 80%				
Load Per Tons @ 75%				
Input kW @ 100% Load				
Input kW @ 85% Load				
Input kW @ 80% Load				
Input kW @ 75% Load				

Life Cycle Calculation (To Be Completed by Designer)				
1st Year ($)				
1st Year x 20 ($)				
Bid Price ($)				
LCC ($)				
Formula: LCC = Bid Price ($) + 1st Year ($) x 20 Years				
Electricity Cost Calculated Based on $0.08 / kWh				

END OF SECTION

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SEAL
031487
ENGINEER
NATHAN D. CESAR
10/22/25

Sheet Keynotes:

16"CHR (BOP=8'-6")
4"VTR (BOP=10'-0")
4"VTR (BOP=7'-4")
16"CHR (BOP=8'-7")
16"CHS (BOP=8'-6")
4"VTR (BOP=7'-1")
4"VTR (BOP=10'-0")
CRM 3_2B
CRM 3_1B
CRM 2_2B
CRM 2_1B
CRM 1_2B
CRM 1_1B
8"MU
8"RCW
48"CWS
42"CWR
6"CHS UP
6"CHR UP
CHILLER HALL
2101
CONTROL ROOM
2102
AT 2102
DCS CONTROL PANELS (OFCI)
ENTRY VESTIBULE
2100
CHEMICAL TREATMENT REMOTE FILL STATION
NO CONTINUATION
B.M.301
B.M.302
B.M.303
B.M.304
B.M.305

FIRE SEPARATION LEGEND

1 HR RATED FIRE SEPARATION
2 HR RATED FIRE SEPARATION

KEYPLAN

Rev	Date	Description of Issue
D	10/17/25	CD FOR BID APPROVAL
C	07/11/25	CD FOR REVIEW
B	12/06/24	DESIGN DEVELOPMENT
A	06/14/24	SCHEMATIC DESIGN

Project

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

Chilled Water Infrastructure Expansion

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

Sheet Title

MECHANICAL PIPING PLAN - SECOND FLOOR - AREA A

Scale: As indicated

Date: 10/17/25
Drawn By: JBG

Project No.: 23480-01
Checked By: GAH

Sheet No.

B.M.212A

1 MECHANICAL PIPING PLAN - SECOND FLOOR - AREA A

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

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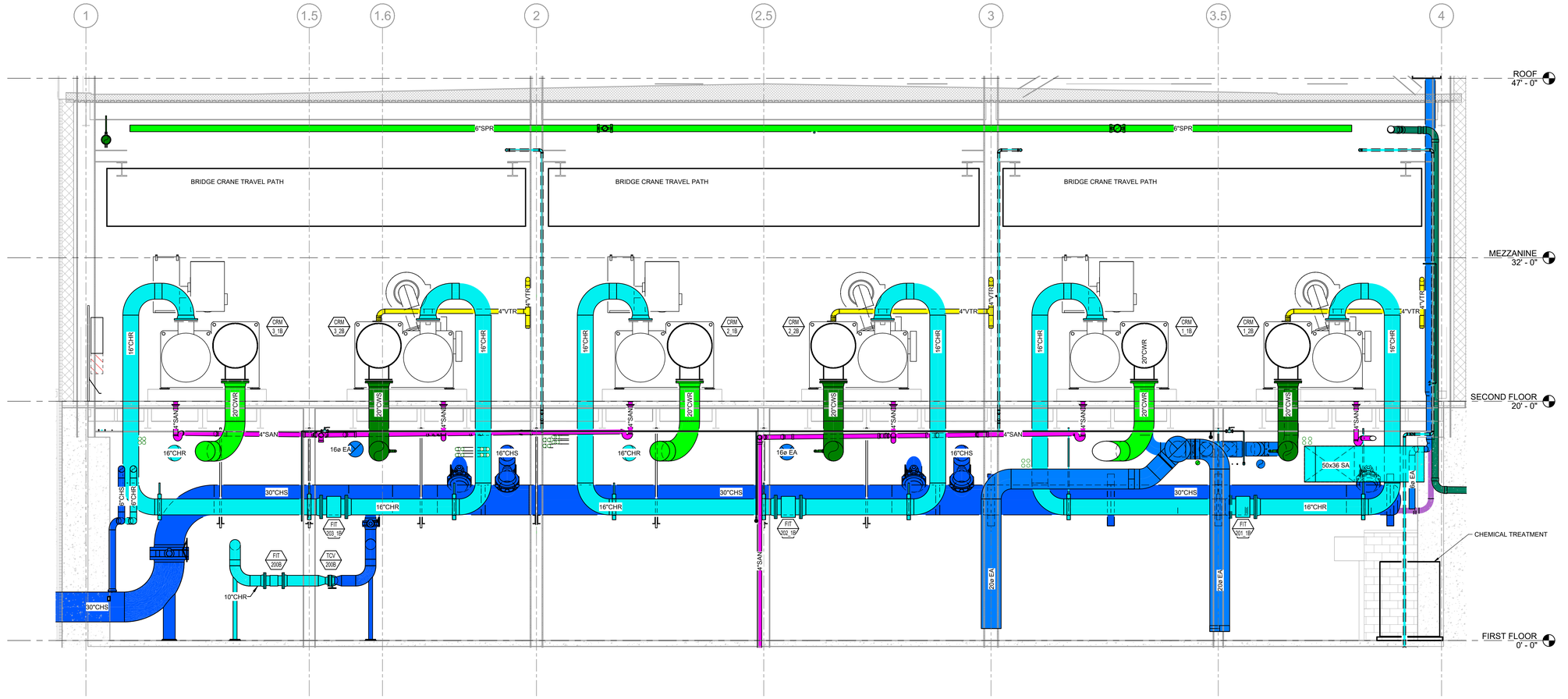
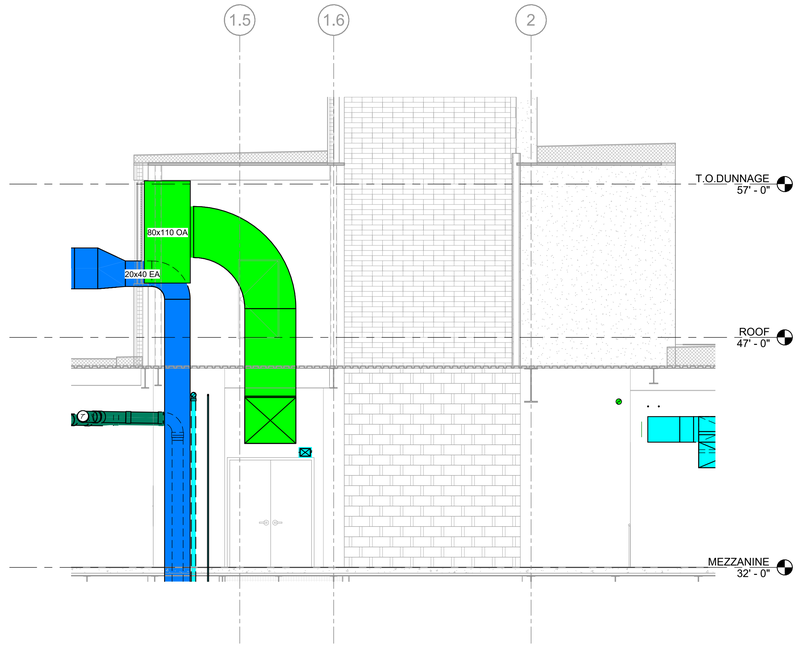
10/17/2025 12:49:33 PM Autodesk Docs://23480-00 UNC CHW Infrastructure Expansion/23480-01_BCP_MEP.rvt



1 **CHILLERS 1-3 LOOKING WEST**
SCALE: 1/4" = 1'-0"



2 **AHU-4 OUTSIDE AIR RISER**
SCALE: 1/4" = 1'-0"

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NORTH CAROLINA
SEAL 031487
ENGINEER
NATHAN D. CESAR
10/22/25

Sheet Keynotes:

Rev	Date	Description of Issue
C	10/17/25	CD FOR BID APPROVAL
B	07/11/25	CD FOR REVIEW
A	12/06/24	DESIGN DEVELOPMENT

Project

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

Chilled Water Infrastructure Expansion

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

Sheet Title

SECTIONS

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

Date: 10/17/25 | Drawn By: JBG

Project No.: 23480-01 | Checked By: GAH

Sheet No.

B.M.302

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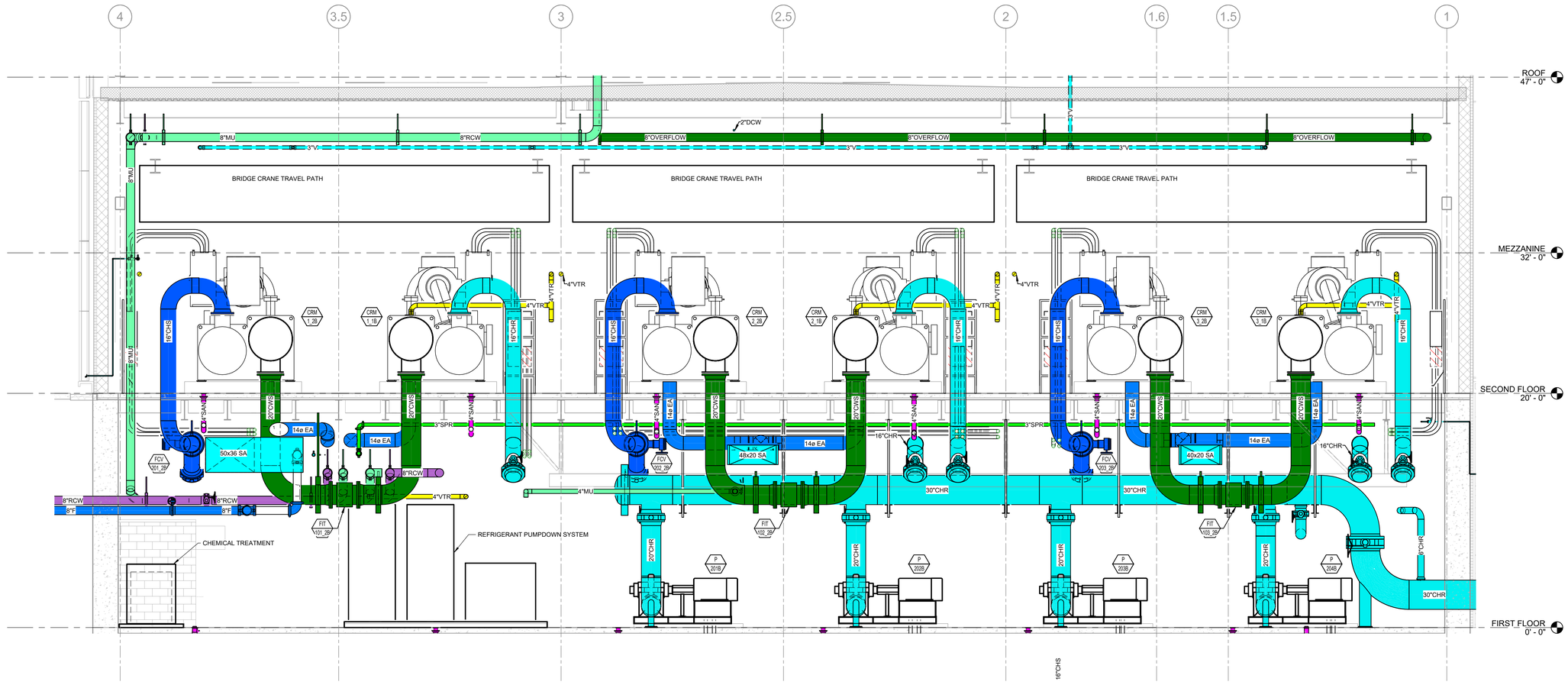
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031487 JOHAN D. CESS

NOT FOR CONSTRUCTION

Sheet Keynotes:



Rev	Date	Description of Issue
C	10/17/25	CD FOR BID APPROVAL
B	07/11/25	CD FOR REVIEW
A	12/06/24	DESIGN DEVELOPMENT

Project

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

Chilled Water Infrastructure Expansion

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

Sheet Title

SECTIONS

Scale

1/4" = 1'-0"

Date	Drawn By
10/17/25	JBG

Project No.	Checked By
23480-01	GAH

Sheet No.

B.M.303

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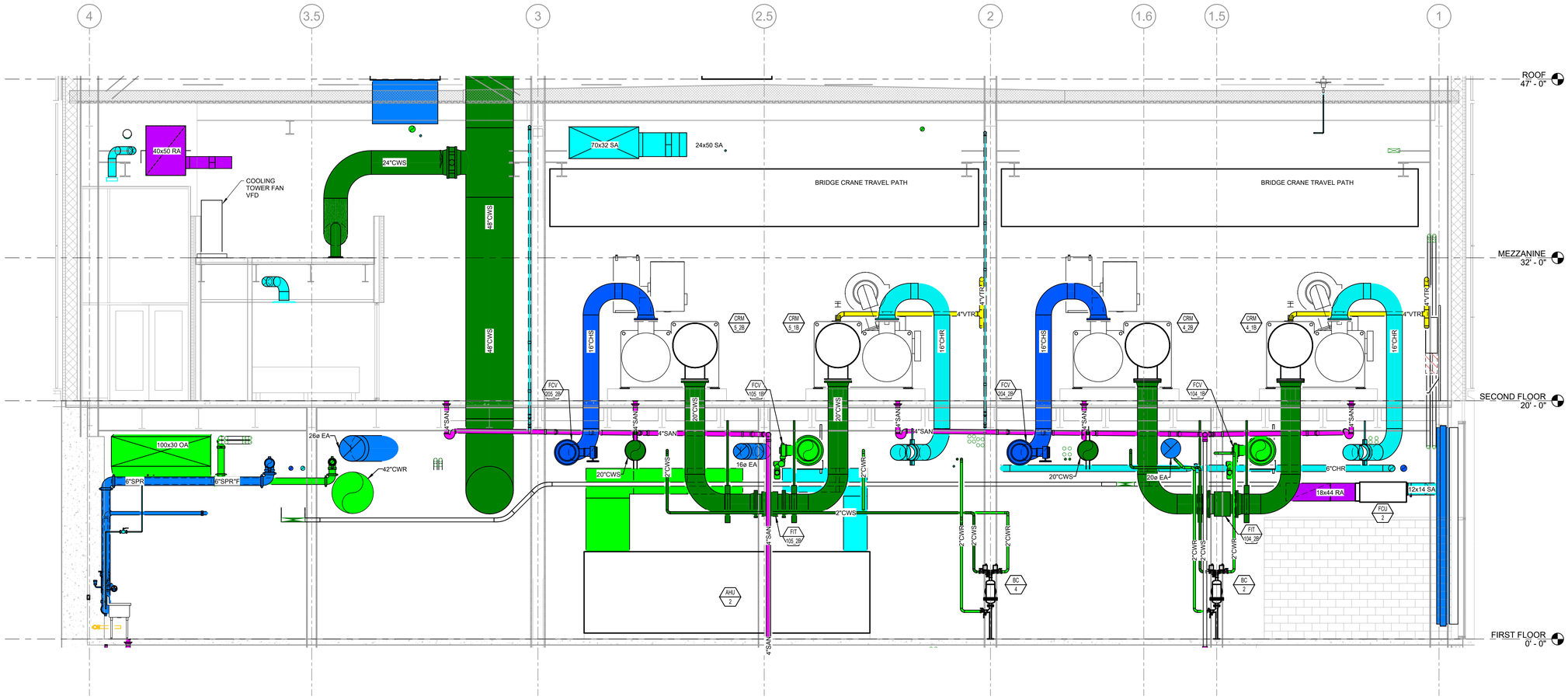


1 **CHILLERS 4-5 LOOKING WEST**
SCALE: 1/4" = 1'-0"

16"CHS

Sheet Keynotes:

Rev	Date	Description of Issue
C	10/17/25	CD FOR BID APPROVAL
B	07/11/25	CD FOR REVIEW
A	12/06/24	DESIGN DEVELOPMENT

Project

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

Chilled Water Infrastructure Expansion

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

Sheet Title

SECTIONS

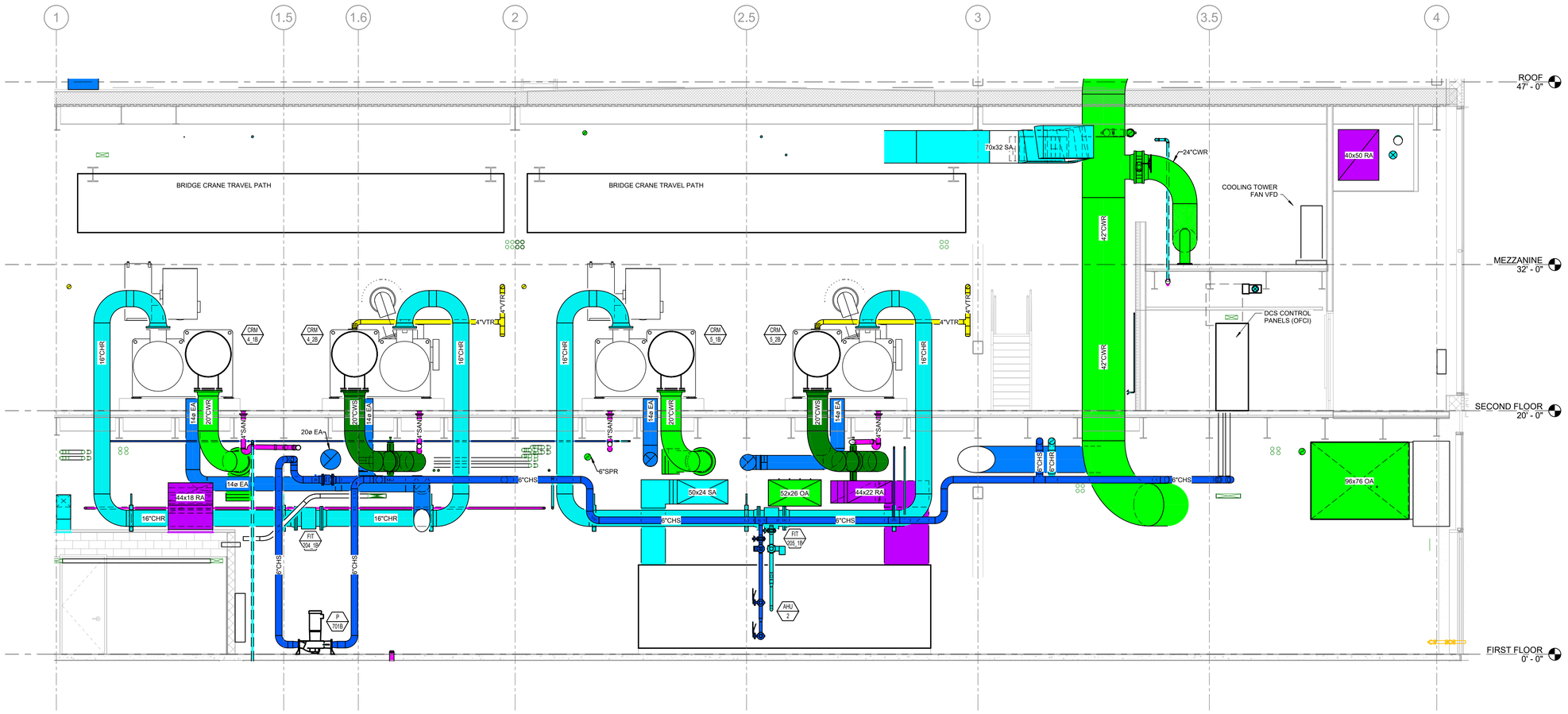
Scale: 1/4" = 1'-0"

Date: 10/17/25 | Drawn By: JBG

Project No.: 23480-01 | Checked By: GAH

Sheet No.

B.M.304



1 **CHILLERS 4-5 LOOKING EAST**
SCALE: 1/4" = 1'-0"

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Sheet Keynotes:

Rev	Date	Description of Issue
C	10/17/25	CD FOR BID APPROVAL
B	07/11/25	CD FOR REVIEW
A	12/06/24	DESIGN DEVELOPMENT

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COOLING TOWERS

23 6510

MARK (CTF)	LOCATION	GPM EACH CELL	MIN. FLOW EACH CELL	MAX. PD (FT) (2)	TEMPERATURE (°F) AIR WB	EWT	LWT	FAN MOTOR (EACH CELL) MAX. HP	VOLT	PHASE	CONTROLLER VFD (Y/N)	REMARKS OWNER PREPURCHASED AND FURNISHED TO CONTRACTOR
301B	ROOF	7,500	3,750	25	80	95	85	200	480	3	Y	(1)
302B	ROOF	7,500	3,750	25	80	95	85	200	480	3	Y	(1)
303B	ROOF	7,500	3,750	25	80	95	85	200	480	3	Y	(1)
304B	ROOF	7,500	3,750	25	80	95	85	200	480	3	Y	(1)
305B	ROOF	7,500	3,750	25	80	95	85	200	480	3	Y	(1)

NOTES:
1. VFD FOR DIRECT DRIVE COOLING TOWER FAN MOTOR PROVIDED BY COOLING TOWER MANUFACTURER.
2. FROM INLET FLANGE CONNECTION.

WATER FLOW METERS

23 0903

MARK (FIT)	SYSTEM	SERVICE	TYPE	CAPACITY (GPM)	SIZE (IN)	MAX. PD (FT)	VOLTAGE	REMARKS
101_2B	CWS	CRM 1_2B	INLINE MAGNETIC	7,500	20	N/A	24	
102_2B	CWS	CRM 2_2B	INLINE MAGNETIC	7,500	20	N/A	24	
103_2B	CWS	CRM 3_2B	INLINE MAGNETIC	7,500	20	N/A	24	
104_2B	CWS	CRM 4_2B	INLINE MAGNETIC	7,500	20	N/A	24	
105_2B	CWS	CRM 5_2B	INLINE MAGNETIC	7,500	20	N/A	24	
201_1B	CHR	CRM 1_1B	INLINE MAGNETIC	4,275	16	N/A	24	
202_1B	CHR	CRM 2_1B	INLINE MAGNETIC	4,275	16	N/A	24	
203_1B	CHR	CRM 3_1B	INLINE MAGNETIC	4,275	16	N/A	24	
204_1B	CHR	CRM 4_1B	INLINE MAGNETIC	4,275	16	N/A	24	
205_1B	CHR	CRM 5_1B	INLINE MAGNETIC	4,275	16	N/A	24	
800A	MU	CHW MAKE-UP	INLINE MAGNETIC	80	2.5	N/A	24	
800B	MU	CHW MAKE-UP	INLINE MAGNETIC	470	4	N/A	24	
200B	CHS	MINIMUM FLOW BYPASS	INLINE MAGNETIC	2,138	10	N/A	24	
300BB	CWS	TOWER BLEED	INLINE MAGNETIC	190	4	N/A	24	
300AB	MU	CW MAKEUP	INLINE MAGNETIC	565	8	N/A	24	
350B	RCW	CW MAKEUP	INLINE MAGNETIC	565	8	N/A	24	

CHILLERS

24 6000

MARK (CRM)	COMPRESSOR TYPE	CHILLER ARRANGEMENT	MAX. OPER. WEIGHT (LBS)	REFRIGERANT CLASSIFICATION	CAPACITY (TONS)	MAXIMUM KW/TON	EVAPORATOR GPM	EWT (°F)	LWT (°F)	PASS	MAX. PD (FT)	FOULING FACTOR	REMARKS OWNER PREPURCHASED AND FURNISHED TO CONTRACTOR
1_1B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,225	0.57	4,275	56	49	1	10.9	0.0001	(1)
1_2B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,275			49	42	1	10.9	0.0001	(1)
2_1B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,225	0.57	4,275	56	49	1	10.9	0.0001	(1)
2_2B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,275			49	42	1	10.9	0.0001	(1)
3_1B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,225	0.57	4,275	56	49	1	10.9	0.0001	(1)
3_2B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,275			49	42	1	10.9	0.0001	(1)
4_1B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,225	0.57	4,275	56	49	1	10.9	0.0001	(1)
4_2B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,275			49	42	1	10.9	0.0001	(1)
5_1B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,225	0.57	4,275	56	49	1	10.9	0.0001	(1)
5_2B	CENTRIFUGAL	SERIES-COUNTERFLOW	60,000	A1 OR B1	1,275			49	42	1	10.9	0.0001	(1)

CHILLERS

MARK (CRM)	CONDENSER GPM	EWT (°F)	LWT (°F)	PASS	MAX. PD (FT)	FOULING FACTOR	ELECTRICAL MAX. POWER INPUT (KW)	MCA (AMPS)	MOP (AMPS)	LRA (AMPS)	RLA (AMPS)	INRUSH	VOLT	PH	STARTER TYPE
1_1B	7,500	90	95	1	10.8	0.00025	686			6440	_	_	480	3	VFD (UNIT MOUNTED)
1_2B		85	90	1	10.8	0.00025	704			6440	_	_	480	3	VFD (UNIT MOUNTED)
2_1B	7,500	90	95	1	10.8	0.00025	686			6440	_	_	480	3	VFD (UNIT MOUNTED)
2_2B		85	90	1	10.8	0.00025	704			6440	_	_	480	3	VFD (UNIT MOUNTED)
3_1B	7,500	90	95	1	10.8	0.00025	686			6440	_	_	480	3	VFD (UNIT MOUNTED)
3_2B		85	90	1	10.8	0.00025	704			6440	_	_	480	3	VFD (UNIT MOUNTED)
4_1B	7,500	90	95	1	10.8	0.00025	686			6440	_	_	480	3	VFD (UNIT MOUNTED)
4_2B		85	90	1	10.8	0.00025	704			6440	_	_	480	3	VFD (UNIT MOUNTED)
5_1B	7,500	90	95	1	10.8	0.00025	686			6440	_	_	480	3	VFD (UNIT MOUNTED)
5_2B		85	90	1	10.8	0.00025	704			6440	_	_	480	3	VFD (UNIT MOUNTED)

NOTES:
1. TWO (2) CHILLERS CONNECTED IN SERIES-COUNTERFLOW (SC) ARRANGEMENT.

PROCESS PUMPS

23 2123

MARK (P)	LOCATION	SERVICE	TYPE	MAX. OPER. WEIGHT (LBS)	CAP. (GPM)	HEAD (FT)	MAX. NPSHR (FT)	MIN. EFF. (%)	SIZE (IN) SUCT.	SIZE (IN) DISCH.	ELECTRICAL CHARACTERISTICS MOTOR VFD	HP	RPM	VOLT	PH	REMARKS
101B	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	9,000	12,500	100	30	81	20	16	YES	400	1200	480	3	(1)
102B	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	9,000	12,500	100	30	81	20	16	YES	400	1200	480	3	(1)
103B	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	9,000	12,500	100	30	81	20	16	YES	400	1200	480	3	(1)
104B	MECHANICAL ROOM	CONDENSER WATER	HORIZONTAL SPLIT CASE	9,000	12,500	100	30	81	20	16	YES	400	1200	480	3	(1)
201B	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	9,000	7,125	150	18	83	16	12	YES	350	1200	480	3	(1)
202B	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	9,000	7,125	150	18	83	16	12	YES	350	1200	480	3	(1)
203B	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	9,000	7,125	150	18	83	16	12	YES	350	1200	480	3	(1)
204B	MECHANICAL ROOM	CHILLED WATER	HORIZONTAL SPLIT CASE	9,000	7,125	150	18	83	16	12	YES	350	1200	480	3	(1)

NOTES:
1. OWNER PREPURCHASED AND FURNISHED TO CONTRACTOR TO INSTALL

PROCESS VARIABLE FREQUENCY DRIVES

23 0515

MARK (VFD)	EQUIPMENT	LOCATION	HP	VOLTS	RPM	PULSE	MAX. ENCLOSURE SIZE (LxWxH)	INPUT CIRCUIT BREAKER	INTERNAL POWER TO MTR HEATER	OUTPUT REACTOR	OUTPUT DV/DT FILTER	BYPASS STARTER	HARMONIC TRAP	SINGLE ENCLOSURE	REMARKS
P-101B	CW PUMP	FIRST FLOOR	400	460	1200	6	70"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-102B	CW PUMP	FIRST FLOOR	400	460	1200	6	70"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-103B	CW PUMP	FIRST FLOOR	400	460	1200	6	70"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-104B	CW PUMP	FIRST FLOOR	400	460	1200	6	70"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-201B	CHW PUMP	FIRST FLOOR	350	460	1200	6	42"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-202B	CHW PUMP	FIRST FLOOR	350	460	1200	6	42"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-203B	CHW PUMP	FIRST FLOOR	350	460	1200	6	42"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-204B	CHW PUMP	FIRST FLOOR	350	460	1200	6	42"x32"x86"	Y	N	N	N	N	N	Y	(3)
P-701B	CHW HVAC PUMP	FIRST FLOOR	20	460	-	6	24"x18"x36"	Y	N	N	N	N	N	Y	(3)
CTF-301B	COOLING TOWER FAN	MEZZANINE	200	460	-	6	35"x22"x56"	Y	Y	N	N	N	N	Y	(1), (2), (3)
CTF-302B	COOLING TOWER FAN	MEZZANINE	200	460	-	6	35"x22"x56"	Y	Y	N	N	N	N	Y	(1), (2), (3)
CTF-303B	COOLING TOWER FAN	MEZZANINE	200	460	-	6	35"x22"x56"	Y	Y	N	N	N	N	Y	(1), (2), (3)
CTF-304B	COOLING TOWER FAN	MEZZANINE	200	460	-	6	35"x22"x56"	Y	Y	N	N	N	N	Y	(1), (2), (3)
CTF-305B	COOLING TOWER FAN	MEZZANINE	200	460	-	6	35"x22"x56"	Y	Y	N	N	N	N	Y	(1), (2), (3)

NOTES:
1. VFD FOR COOLING TOWER PERMANENT MAGNET MOTOR (PMM) APPLICATION SHALL BE PROVIDED WITH THE COOLING TOWER VENDOR AND COORDINATED FOR THE SPECIFIC APPLICATION
2. REFER TO THE "E SERIES" SHEETS FOR THE DESIGN INTENT FOR THE VFD WIRING SCHEMATIC TO INCLUDE 120V AND LV WIRING BETWEEN THE VFD AND THE COOLING TOWER COMPONENTS.'

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SCHEDULES

Scale: NTS

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