

**ARKANSAS STATE HIGHWAY COMMISSION  
ARDOT - EQUIPMENT AND PROCUREMENT DIVISION  
BID INVITATION**

Bid Number: M-18-028P

**BID OPENING LOCATION:**  
ARDOT Equipment and Procurement Division  
11302 West Baseline Road  
Little Rock, AR 72209

**MAIL TO:**  
ARDOT Equipment and Procurement Division  
P.O. Box 2261  
Little Rock, AR 72203

**DELIVER TO:**  
ARDOT Equipment and Procurement Division  
11302 West Baseline Road  
Little Rock, AR 72209

Bid Opening Date: February 27, 2018 Time: 11:00 a.m.

Sealed bids for furnishing the commodities and/or services described below, subject to the Standard Bid Conditions of this Bid Invitation will be received at the above-noted mail and delivery locations until the above-noted bid opening date and time, and then publicly opened at the above-noted bid opening location. **Bids must be submitted on this form, with attachments when appropriate, or bids will be rejected. Late bids and unsigned bids will not be considered.**

In compliance with this Bid Invitation and subject to all the Conditions thereof, the undersigned offers and agrees to furnish any and all items upon which prices are quoted, at the price set opposite each item.

Company Name: \_\_\_\_\_

Name (Type or Print): \_\_\_\_\_

Address: \_\_\_\_\_

Title: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Federal Tax ID or Social Security No.: \_\_\_\_\_

**Signature:** \_\_\_\_\_

Signature must be legible, original (not photocopied) and in ink. Unsigned bids will be rejected.

| Item No. | Description  | Quantity | Unit | Unit Price | Amount |  |  |  |  |  |
|----------|--|----------|------|------------|--------|--|--|--|--|--|
|          | <p><b>ARDOT Central Office Chiller and Cooler Tower Replacement located at Arkansas Department of Transportation, 10324 Interstate 30, Little Rock, Arkansas (Job #42-98)</b></p> <p align="center">LUMP SUM _____</p> <p><b>A mandatory pre-bid meeting is scheduled for all potential bidders on February 20, 2018. Contact Phillip Watkins, Project Coordinator (501-569-2627) for time and location.</b></p> <p>To meet the requirements of Arkansas State Highway and Transportation Department Specifications and Drawings G1.1, M1.1 &amp; M2.1 attached to and made a part of this bid.</p> <p>All bidders should complete and return the Eligible Bidder Certification (Attachment A), Disclosure Form (see Page 2 of Standard Bid Conditions – Item 18) and Restriction of Boycott of Israel Certification issued with this bid. A current copy of the DFA Illegal Immigrant Contractor Disclosure Certification (see Page 2 of Standard Bid Conditions – Item 17) should also be submitted with bid. These forms are kept on file and remain current for one year from date of submission. Forms do not need to be submitted again, during that time, unless there is a status change.</p> <p>Bid price shall include all labor, materials, and equipment necessary to perform the work as specified, and shall further include all licenses, fees, permits, royalties, and <u>all taxes</u>. Bid price shall represent full compensation for completion of the work. This provision supersedes Condition 5 on page 1 of Standard Bid Conditions. Payment will be made in accordance with Arkansas State Highway &amp; Transportation Department Standard Specifications and Applicable Special Provisions.</p> <p>Subsections 105.04, 108.07, 109.01 and 109.02 of the Arkansas State Highway and Transportation Department Standard Specifications for Highway Construction, Edition of 2014, will be in effect. (Specifications are accessible on our web site at <a href="http://www.ardot.gov">www.ardot.gov</a>.)</p> <p><b>Bid Bond</b> in the amount of 5% of total bid price required of all bidders at time of bid opening or bid will be rejected. <b>Personal and company checks are not acceptable as Bid Bonds.</b> See Condition 4 on page 1 of Standard Bid Conditions. <b>Performance Bond only</b> (no checks of any kind allowed) in the amount of 100% of total bid price will be required of successful bidder prior to providing goods/services. See Condition 4 on page 1 of Standard Bid Conditions.</p> <p>The successful bidder will be required to complete within 90 days after award.</p> <p>Arkansas Contractor's License No. _____<br/>Current Arkansas Contractor's License Number must be listed or bid will be rejected (A.C.A. ¶17-25-101 <i>et seq.</i>).</p> <p>Bids and Specifications are available on-line by going to the ARDOT Web Site – <a href="http://www.ardot.gov">www.ardot.gov</a> and clicking on "Commodities and Services Bids/Contracts Information". Tabulations will also be available at this site after award of bid/contract. If you have any questions, call this office at 501-569-2667.<br/>(42-461) 55-02, 63-00</p> |          |      |            |        |  |  |  |  |  |

## ARDOT - STANDARD BID CONDITIONS

1. **GENERAL:** Any special terms and conditions included in the invitation for bid override these standard terms and conditions. The standard terms and conditions and any special terms and conditions become part of any contract entered into if any or all parts of the bid are accepted by the Arkansas Department of Transportation (ARDOT).
2. **ACCEPTANCE AND REJECTION:** ARDOT reserves the right to reject any or all bids, to accept bids in whole or in part (unless otherwise indicated by bidder), to waive any informalities in bids received, to accept bids on materials or equipment with variations from specifications where efficiency of operation will not be impaired, and to award bids to best serve the interest of the State.
3. **PRICES:** Unless otherwise stated in the Bid Invitation, the following will apply: (1) unit prices shall be bid, (2) prices should be stated in units of quantity specified (feet, each, lbs., etc.), (3) prices must be F.O.B. destination specified in bid, (4) prices must be firm and not subject to escalation, (5) bid must be firm for acceptance for 30 days from bid opening date. In case of errors in extension, unit prices shall govern. Discounts from bid price will not be considered in making awards.
4. **BID BONDS AND PERFORMANCE BONDS:** If required, a **Bid Bond** in the form of a cashier's check, certified check, or surety bond issued by a surety company, in an amount stated in the Bid Invitation, must accompany bid. **Personal and company checks are not acceptable as Bid Bonds.** Failure to submit a Bid Bond as required will cause a bid to be rejected. The Bid Bond will be forfeited as liquidated damages if the successful bidder fails to provide a required Performance Bond within the period stipulated by ARDOT or fails to honor their bid. When a bidder claims and can show clear and convincing evidence that a material mistake was made in the bid and was not the bid intended, the bidder may be permitted to withdraw their bid prior to award without forfeiture of bid bond. Cashier's checks and certified checks submitted as Bid Bonds will be returned to unsuccessful bidders; surety bonds will be retained. The successful bidder will be required to furnish a **Performance Bond** in an amount stated in the Bid Invitation and in the form of a cashier's check, certified check, or surety bond issued by a surety company, unless otherwise stated in the Bid Invitation, as a guarantee of delivery of goods/services in accordance with the specifications and within the time established in the bid. **Personal and company checks are not acceptable as Performance Bonds.** In some cases, a cashier's check or certified check submitted as a Bid Bond will be held as the Performance Bond of the successful bidder. Cashier's checks or certified checks submitted as Performance Bonds will be refunded shortly after payment has been made to the successful bidder for completion of all terms of the bid; surety bonds will be retained. Surety bonds must be issued by a surety company authorized to do business in Arkansas, and must be signed by a Resident Local Agent licensed by the Arkansas State Insurance Commissioner to represent that surety company. Resident Agent's Power-of-Attorney must accompany the surety bond. Certain bids involving labor will require Performance Bonds in the form of surety bonds only (no checks of any kind allowed). These bonds shall not only serve to guarantee the completion of the work, but also to guarantee the excellence of both workmanship and material until the work is finally accepted and the provisions of the Plans, Specifications, and Special Provisions fulfilled. In such cases, the company issuing the surety bond must comply with all stipulations herein and must be named in the U. S. Treasury listing of companies holding Certificates of Authority as acceptable sureties on Federal Bonds and as acceptable reinsuring companies. Any excess between the face amount of the bond and the underwriting limitation of the bonding company shall be protected by reinsurance provided by an acceptable reinsuring company. Annual Bid and Performance Bonds on file with E & P Division must have sufficient unencumbered funds to meet current bonding requirements, or the bid will be rejected, unless the balance is submitted as set forth above, prior to bid opening.
5. **TAXES:** The ARDOT is not exempt from Arkansas State Sales and Use Taxes, or local option city/county sales taxes, when applicable, and bidders are responsible to the State Revenue Department for such taxes. These taxes should not be included in bid prices, but where required by law, will be paid by the ARDOT as an addition thereto, and should be added to the billing to the ARDOT. The ARDOT is exempt from Federal Excise Taxes on all commodities except motor fuels; and excise taxes should not be included in bid prices except for motor fuels. Where applicable, tax exemption certificates will be furnished by the ARDOT.
6. **"ALL OR NONE" BIDS:** Bidders who wish to bid "All or None" on two or more items shall so stipulate on the face of bid sheet; otherwise, bid may be awarded on an individual item basis.
7. **SPECIFICATIONS:** Complete specifications should be attached for any substitution or alternate offered, or where amplification is necessary. Bidder's name must be placed on all attachments to the bid.
8. **EXCEPTIONS TO SPECIFICATIONS:** Any exceptions to the bid specifications must be stated in the bid. Any exceptions to manufacturer's published literature must be stated in the bid, or it will be assumed that bidder is bidding exactly as stated in the literature.
9. **BRAND NAME REFERENCES:** All brand name references in bid specifications refer to that commodity or its equivalent, unless otherwise stated in Bid Invitation. Bidder should state brand or trade name of item being bid, if such name exists.
10. **FREIGHT:** All freight charges should be included in bid price. Any change in common carrier rates authorized by the Interstate Commerce Commission will be adjusted if such change occurs after the bid opening date. Receipted common carrier bills that reflect ICC authorized rate changes must be furnished.

11. **SAMPLES, LITERATURE, DEMONSTRATIONS:** Samples and technical literature must be provided free of any charge within 14 days of ARDOT request, and free demonstrations within 30 days, unless ARDOT extends time. Failure to provide as requested within this period may cause bid to be rejected. Samples, literature and demonstrations must be substantially the same as the item(s) being bid, unless otherwise agreed to by ARDOT. Samples that are not destroyed will be returned upon request at bidders expense. Samples from successful bidders may be retained for comparison with items actually furnished.
12. **GUARANTY:** Unless otherwise indicated in Bid Invitation, it is understood and agreed that any item offered or shipped on this bid shall be newly manufactured, latest model and design, and in first class condition; and that all containers shall be new, suitable for storage or shipment and in compliance with all applicable laws relating to construction, packaging, labeling and registration.
13. **BACKORDERS OR DELAY IN DELIVERY:** Backorders or failure to deliver within the time required may constitute default. Vendor must give written notice to the ARDOT, as soon as possible, of the reason for any delay and the expected delivery date. The ARDOT has the right to extend delivery if reasons appear valid. If reason or delivery date is not acceptable, vendor is in default.
14. **DEFAULT:** All commodities furnished will be subject to inspection and acceptance by ARDOT after delivery. Default in promised delivery or failure to meet specifications authorizes the ARDOT to cancel award or any portion of same, to reasonably purchase commodities or services elsewhere and to charge full increase, if any, in cost and handling to defaulting vendor. Applicable bonds may be forfeited.
15. **ETHICS:** *"It shall be a breach of ethical standards for a person to be retained, or to retain a person, to solicit or secure a State contract upon an agreement of understanding for a commission, percentage, brokerage, or contingent fee, except for retention of bona fide employees or bona fide established commercial selling agencies maintained by the contractor for the purpose of securing business."* (Arkansas Code, Annotated, Section 19-11-708).
16. **NOTICE OF NONDISCRIMINATION:** The Arkansas State Highway Commission, through ARDOT, complies with all civil rights provisions of federal statutes and related authorities that prohibit discrimination in programs and activities receiving federal financial assistance. Therefore, ARDOT does not discriminate on the basis of race, sex, color, age, national origin, religion (not applicable as a protected group under the Federal Motor Carrier Safety Administration Title VI Program), disability, Limited English Proficiency (LEP), or low-income status in the admission, access to and treatment in the ARDOT's programs and activities, as well as the ARDOT's hiring or employment practices. Complaints of alleged discrimination and inquiries regarding the ARDOT's nondiscrimination policies may be directed to Joanna P. McFadden Section Head – EEO/DBE (ADA/504/Title VI Coordinator), P. O. Box 2261, Little Rock, AR 72203, (501)569-2298, (Voice/TTY 711), or the following email address: [joanna.mcfadden@ardot.gov](mailto:joanna.mcfadden@ardot.gov). Free language assistance for Limited English Proficient individuals is available upon request. This notice is available from the ADA/504/Title VI Coordinator in large print, on audiotape and in Braille.
17. **PROHIBITION OF EMPLOYMENT OF ILLEGAL IMMIGRANTS:** Pursuant to Arkansas Code Annotated 19-11-105, all bidders must certify prior to award of a contract that they **do not** employ or contract with any illegal immigrant(s) in its contract with the state. Bidders shall certify online at <https://www.ark.org/dfa/immigrant/index.php>.
18. **DISCLOSURE:** Failure to make any disclosure required by Governor's Executive Order 98-04, or any violation of any rule, regulation, or policy adopted pursuant to that order, **shall** be a material breach of the terms of this contract. Any contractor, whether an individual or entity, who fails to make the required disclosure or who violates any rule, regulation, or policy **shall** be subject to all legal remedies available to the agency.

ATTACHMENT A

**ELIGIBLE BIDDER CERTIFICATION**

The Bidder represents and warrants for itself, its employees and its subcontractors and certifies they:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
2. Have not within a three-year period preceding thus Bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph two (2) of this Certification;
4. Have not within a one-year period preceding this application/Bid had one or more public transactions (Federal, State, or local) terminated for cause or default; and

The Bidder represents, warrants and acknowledges the understanding that restrictions placed on the employment of labor or on the scale of pay for the work on a contract will be the requirements of the Fair Labor Standards Act (Federal Wage-Hour Law) of 1938, 28 USC §201 et seq., and other applicable labor laws.

The person executing this Certification further represents, warrants and affirms the truthfulness and accuracy of the contents of the statements submitted on or with this Certification and understands that the provisions of 31 USC §3801 et seq. are applicable thereto.

\_\_\_\_\_

BIDDER NAME

BY: \_\_\_\_\_

Signature

TITLE: \_\_\_\_\_

# CONTRACT AND GRANT DISCLOSURE AND CERTIFICATION FORM

Failure to complete all of the following information may result in a delay in obtaining a contract, lease, purchase agreement, or grant award with any Arkansas State Agency.

SUBCONTRACTOR: \_\_\_\_\_ SUBCONTRACTOR NAME: \_\_\_\_\_

Yes  No

IS THIS FOR:

TAXPAYER ID NAME: \_\_\_\_\_  Goods?  Services?  Both?

YOUR LAST NAME: \_\_\_\_\_ FIRST NAME: \_\_\_\_\_ M.I.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP CODE: \_\_\_\_\_ COUNTY: \_\_\_\_\_

**AS A CONDITION OF OBTAINING, EXTENDING, AMENDING, OR RENEWING A CONTRACT, LEASE, PURCHASE AGREEMENT, OR GRANT AWARD WITH ANY ARKANSAS STATE AGENCY, THE FOLLOWING INFORMATION MUST BE DISCLOSED:**

## FOR INDIVIDUALS\*

Indicate below if: you, your spouse or the brother, sister, parent, or child of you or your spouse is a current or former: member of the General Assembly, Constitutional Officer, State Board or Commission Member, or State Employee:

| Position Held                    | Mark ( ✓ ) |        | Name of Position of Job Held<br><small>(senator, representative, name of board/ commission, data entry, etc.)</small> | For How Long? |             | What is the person(s) name and how are they related to you?<br><small>(i.e., Jane Q. Public, spouse, John Q. Public, Jr., child, etc.)</small> |          |
|----------------------------------|------------|--------|---|---------------|-------------|--|----------|
|                                  | Current    | Former |   | From<br>MM/YY | To<br>MM/YY | Person's Name(s)   | Relation |
| General Assembly                 |            |        |   |               |             |  |          |
| Constitutional Officer           |            |        |   |               |             |  |          |
| State Board or Commission Member |            |        |   |               |             |  |          |
| State Employee                   |            |        |   |               |             |  |          |

None of the above applies

## FOR AN ENTITY (BUSINESS)\*

Indicate below If any of the following persons, current or former, hold any position of control or hold any ownership interest of 10% or greater in the entity: member of the General Assembly, Constitutional Officer, State Board or Commission Member, State Employee, or the spouse, brother, sister, parent, or child of a member of the General Assembly, Constitutional Officer, State Board or Commission Member, or State Employee. Position of control means the power to direct the purchasing policies or influence the management of the entity.

| Position Held                    | Mark ( ✓ ) |        | Name of Position of Job Held<br><small>(senator, representative, name of board/ commission, data entry, etc.)</small> | For How Long? |             | What is the person(s) name and what is his/her % of ownership interest and/or what is his/her position of control? |                        |                     |
|----------------------------------|------------|--------|---|---------------|-------------|--|------------------------|---------------------|
|                                  | Current    | Former |   | From<br>MM/YY | To<br>MM/YY | Person's Name(s)   | Ownership Interest (%) | Position of Control |
| General Assembly                 |            |        |   |               |             |  |                        |                     |
| Constitutional Officer           |            |        |   |               |             |  |                        |                     |
| State Board or Commission Member |            |        |   |               |             |  |                        |                     |
| State Employee                   |            |        |   |               |             |  |                        |                     |

None of the above applies

## Contract and Grant Disclosure and Certification Form

*Failure to make any disclosure required by Governor's Executive Order 98-04, or any violation of any rule, regulation, or policy adopted pursuant to that Order, shall be a material breach of the terms of this contract. Any contractor, whether an individual or entity, who fails to make the required disclosure or who violates any rule, regulation, or policy shall be subject to all legal remedies available to the agency.*

As an additional condition of obtaining, extending, amending, or renewing a contract with a state agency I agree as follows:

1. Prior to entering into any agreement with any subcontractor, prior or subsequent to the contract date, I will require the subcontractor to complete a **CONTRACT AND GRANT DISCLOSURE AND CERTIFICATION FORM**. Subcontractor shall mean any person or entity with whom I enter an agreement whereby I assign or otherwise delegate to the person or entity, for consideration, all, or any part, of the performance required of me under the terms of my contract with the state agency.

2. I will include the following language as a part of any agreement with a subcontractor:

Failure to make any disclosure required by Governor's Executive Order 98-04, or any violation of any rule, regulation, or policy adopted pursuant to that Order, shall be a material breach of the terms of this subcontract. The party who fails to make the required disclosure or who violates any rule, regulation, or policy shall be subject to all legal remedies available to the contractor.

3. No later than ten (10) days after entering into any agreement with a subcontractor, whether prior or subsequent to the contract date, I will mail a copy of the **CONTRACT AND GRANT DISCLOSURE AND CERTIFICATION FORM** completed by the subcontractor and a statement containing the dollar amount of the subcontract to the state agency.

|                             |             |                 |
|-----------------------------|-------------|-----------------|
| Signature _____             | Title _____ | Date _____      |
| Vendor Contact Person _____ | Title _____ | Phone No. _____ |

|                     |                   |                             |                         |                             |
|---------------------|-------------------|-----------------------------|-------------------------|-----------------------------|
| Agency Use Only     |                   |                             |                         |                             |
| Agency Number _____ | Agency Name _____ | Agency Contact Person _____ | Contact Phone No. _____ | Contract or Grant No. _____ |

# RESTRICTION OF BOYCOTT OF ISRAEL CERTIFICATION

Pursuant to Arkansas Code Annotated § 25-1-503, a public entity **shall not** enter into a contract valued at \$1,000 or greater with a company unless the contract includes a written certification that the person or company is not currently engaged in, and agrees for the duration of the contract not to engage in, a boycott of Israel.

By signing below, the Contractor agrees and certifies that they do not boycott Israel and will not boycott Israel during the remaining aggregate term of the contract.

If a company does boycott Israel, see Arkansas Code Annotated § 25-1-503.

|                                   |  |
|-----------------------------------|--|
| Bid Number/Contract Number        |  |
| Description of product or service |  |
| Contractor name                   |  |

Contractor Signature: \_\_\_\_\_  
Signature must be hand written, in ink

Date: \_\_\_\_\_

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
JOB NO. 42-98  
CENTRAL OFFICE CHILLER AND COOLING TOWER REPLACEMENT  
LITTLE ROCK  
PROJECT MANUAL**

**SECTION 01 10 00 - SUMMARY**

**PART 1 - GENERAL**

**1.1 PROJECT INFORMATION**

- A. Project Identification: Central Office Chiller and Cooling Tower Replacement.
  - 1. Project Location: 10324 I-30, Little Rock, AR 72209.
- B. Owner: **Arkansas Department of Transportation.**
  - 1. Owner's Representative: **Phillip Watkins, Project Coordinator**  
**9003 Mabelvale Pike, Little Rock, AR 72209**  
**Office: (501) 569-4950 Mobile: (501) 351-0488**  
**Fax: (501) 569-2011**
- C. The Work consists of the replacement of (1) 200 ton and (1) 130 ton McQuay Centrifugal Water Chillers and (3) 250 ton Evapco Cooling Towers and steel frames under towers and includes installation and startup of Automated Logic Chiller Water System Optimizer in the ARDOT Central Office Boiler Room.

**1.2 WORK COVERED BY THE CONTRACT DOCUMENTS**

- A. Removal of the existing 200 ton McQuay and 130 ton McQuay chillers, all (3) 250 ton Evapco cooling towers and steel frames, and includes the installation of the equipment specified in these documents at the Central Office Mechanical Building of the Arkansas Department of Transportation Headquarters as indicated in these Construction Documents, or as directed by the Project Coordinator.
- B. The work shall include all labor, materials, equipment, construction tools, machines, services, utilities, and fuel, required to construct the work and place the facilities constructed into operation to form a complete, operating system.
- C. Project shall be constructed under a single prime contract and shall include provision for a complete one (1) year warranty period for all aspects of the project with the exception of damage due to normal wear conditions. The warranty period shall commence upon acceptance of the work following a Semi-Final Inspection (as defined in Section 01 77 00). With partial acceptance of work, only the warranty applicable to that portion of the work shall be deemed to be in effect. This warranty will be in addition to specific product or installation warranties from suppliers or subcontractors.



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**1.3 WORK RESTRICTIONS**

- A. Contractor's Use of Premises: During construction, Contractor will have full use of building indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project and as follows:
  - 1. Owner will occupy premises during construction. Perform construction only during normal working hours (Monday thru Friday), unless otherwise agreed to in advance by Owner. Clean up work areas and return to usable condition at the end of each work period.
- B. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- C. Plant must remain in operation during replacement of Chillers and Towers.

**END OF SECTION 01 10 00**

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
JOB NO. 42-98  
CENTRAL OFFICE CHILLER AND COOLING TOWER REPLACEMENT  
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**SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES**

**PART 1 - GENERAL**

**1.1 PAYMENT PROCEDURES**

- A. Payments to the Contractor will be made for the actual quantities of contract items completed and accepted according to the plans and specification for "ARDOT Central Office Chiller and Cooling Tower Replacement", which shall be full compensation for all materials, labor, tools, equipment, machinery, drayage, rigging, fees, permits, clean-up, guarantees and any and all incidental items required to complete the work.
- B. Application for Payment Forms: Use forms acceptable to Owner as form for Applications for Payment.
- C. Submit a Schedule of Values at least five days before the initial Application for Payment. Break down the Contract Sum into at least one line item for each Specification Section in the Project Manual table of contents. Coordinate the schedule of values with Contractor's construction schedule.
- D. Arrange schedule of values consistent with format of AIA Document G703.
- E. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- F. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
- G. Provide separate line items in the schedule of values for initial cost of materials and for total installed value of that part of the Work.
- H. Provide a separate line item in the schedule of values for each allowance.
- I. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

**END OF SECTION 01 20 00**

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
JOB NO. 42-98  
CENTRAL OFFICE CHILLER AND COOLING TOWER REPLACEMENT  
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**SECTION 01 25 00 - SUBSTITUTION PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUBSTITUTION PROCEDURES**

- A. Substitutions include changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- B. Substitution Requests: Submit one request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Submit requests within 10 days after the Notice of Award.
  - 3. Identify product to be replaced and show compliance with requirements for substitutions. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.
- C. The Department will review proposed substitutions and notify Contractor of their acceptance or rejection. If necessary, the Department will request additional information or documentation for evaluation.
  - 1. The Department will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- D. Do not submit unapproved substitutions on Shop Drawings or other submittals.

**END OF SECTION 01 25 00**

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
JOB NO. 42-98  
CENTRAL OFFICE CHILLER AND COOLING TOWER REPLACEMENT  
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**SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES**

**PART 1 - GENERAL**

**1.1 CONTRACT MODIFICATION PROCEDURES**

- A. The Department will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.
- B. Owner-Initiated Proposal Requests: The Department will issue a detailed description of proposed changes in the Work.
  - 1. Proposal Requests are not instructions either to stop work in progress or to execute the proposed change.
- C. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Department.
- D. On Owner's approval of a Proposal Request, the Department will issue a Change Order for signatures of Owner and Contractor, for all changes to the Contract Sum or the Contract Time.

**END OF SECTION 01 26 00**

**ARKANSAS DEPARTMENT OF TRANSPORTATION  
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**SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 PROJECT MANAGEMENT AND COORDINATION**

- A. Subcontract List: Submit a written summary identifying individuals or firms proposed for each portion of the Work.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. List e-mail addresses and telephone numbers.
- C. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- D. Requests for Information (RFIs): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Use forms acceptable to Owner.

**1.2 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 2. Submit 1 copy of each action submittal. The Department will return 1 copy.
  - 3. Submit 1 copy of each informational submittal. The Department will return 1 copy.
- B. Paper Submittals: Place a permanent label or title block on each submittal for identification. Include the following information on the label:
  - 1. Project name.
  - 2. Date.
  - 3. Name and address of Contractor.
  - 4. Name and address of subcontractor or supplier.
  - 5. Number and title of appropriate Specification Section.
- C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

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1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with unique identifier, including project identifier, Specification Section number, and revision identifier.
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by ARDOT Engineer.
- D. Identify options requiring selection by ARDOT Engineer.
- E. Identify deviations from the Contract Documents on submittals.
- F. Contractor's Construction Schedule Submittal Procedure:
1. Submit required submittals in the following format:
    - a. Working electronic copy of schedule file, where indicated.
    - b. PDF electronic file.
    - c. 1 paper copies.
  2. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

## **PART 2 - PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections.
1. Submit electronic submittals via email as PDF electronic files.
    - a. The Department will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

### **2.2 ACTION SUBMITTALS**

- A. Submit 1 paper copies of each submittal unless otherwise indicated. The Department will return 1 copies.
- B. Product Data: Mark each copy to show applicable products and options. Include the following:
1. Manufacturer's written recommendations, product specifications, and installation instructions.

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2. Wiring diagrams showing factory-installed wiring.
  3. Printed performance curves and operational range diagrams.
  4. Testing by recognized testing agency.
  5. Compliance with specified standards and requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
1. Dimensions and identification of products.
  2. Fabrication and installation drawings and roughing-in and setting diagrams.
  3. Wiring diagrams showing field-installed wiring.
  4. Notation of coordination requirements.
  5. Notation of dimensions established by field measurement.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include name of manufacturer and product name on label.
1. If variation is inherent in material or product, submit at least 1 set of paired units that show variations.

### **2.3 INFORMATIONAL SUBMITTALS**

- A. Informational Submittals: Submit 1 paper copies of each submittal unless otherwise indicated. ARDOT Engineer will not return copies.
- B. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

### **2.4 DELEGATED DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to ARDOT Engineer.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit 1 copy of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

**2.5 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Provide construction schedule to the Project Coordinator within 15 days of Notice to Proceed.

**PART 3 - EXECUTION**

**3.1 SUBMITTAL REVIEW**

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to the Department.
- B. The Department will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp, and will mark stamp appropriately to indicate action.
- C. Informational Submittals: The Department will review each submittal and will not return it, or will return it if it does not comply with requirements. The Department will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

**3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Updating: At weekly intervals, update schedule to reflect actual construction progress and activities.

**END OF SECTION 01 30 00**



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**SECTION 016000 - PRODUCT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.
  - 1. Show compliance with requirements for comparable product requests.
  - 2. ARDOT Engineer will review the proposed product and notify Contractor of its acceptance or rejection.
- C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.
- D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.
- E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store materials in a manner that will not endanger Project structure.
  - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- F. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

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**PART 2 - PRODUCTS**

**2.1 PRODUCT SELECTION PROCEDURES**

- A. Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at the time of installation.
1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
  2. Where products are accompanied by the term "as selected," ARDOT Engineer will make selection.
  3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:
1. Products:
    - a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
    - b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.
  2. Manufacturers:
    - a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.
    - b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.
  3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.

**2.2 COMPARABLE PRODUCTS**

- A. ARDOT Engineer will consider Contractor's request for comparable product when the following conditions are satisfied:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.

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3. List of similar installations for completed projects, if requested.
4. Samples, if requested.

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION 016000**

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**SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 CLOSEOUT SUBMITTALS**

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Operation and Maintenance Data: Submit one copy of manual.
- D. PDF Electronic File: Assemble manual into a composite electronically indexed file. Submit on digital media.
- E. Record Drawings: Submit one set(s) of marked-up record prints.
- F. Record Digital Data Files: Submit data file and one set(s) of plots.
- G. Record Product Data: Submit one paper copy annotated PDF electronic files and directories of each submittal.

**1.2 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
- B. Submittals Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Submit closeout submittals specified in other sections, including project record documents, operation and maintenance manuals, property surveys, similar final record information, warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 2. Submit maintenance material submittals specified in other sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer.
  - 3. Submit test/adjust/balance records.
  - 4. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Advise Owner of pending insurance changeover requirements.

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2. Complete startup and testing of systems and equipment.
  3. Perform preventive maintenance on equipment used prior to Substantial Completion.
  4. Advise Owner of changeover in heat and other utilities.
  5. Remove temporary facilities and controls.
  6. Complete final cleaning requirements, including touchup painting.
  7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will proceed with inspection or advise Contractor of unfulfilled requirements. Engineer will notify contractor when Substantial Completion inspection is complete and will advise Contractor of items that must be completed or corrected before certificate will be issued.

### **1.3 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting inspection for determining final completion, complete the following:
1. Submit a final Application for Payment.
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
- B. Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

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- B. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## **2.2 OPERATION AND MAINTENANCE DOCUMENTATION**

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system.
- C. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Include the following:
  - 1. Manufacturer's operation and maintenance documentation.
  - 2. Maintenance and service schedules.
  - 3. Maintenance service contracts. Include name and telephone number of service agent.
  - 4. Emergency instructions.
  - 5. Spare parts list and local sources of maintenance materials.
  - 6. Wiring diagrams.
  - 7. Copies of warranties. Include procedures to follow and required notifications for warranty claims

## **2.3 RECORD DRAWINGS**

- A. Record Prints: Maintain a set of prints of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. Mark to show actual installation where installation varies from that shown originally. Accurately record information in an acceptable drawing technique.
  - 1. Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings.
  - 1. Format: Annotated PDF electronic file.

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**PART 3 - EXECUTION**

**3.1 EXAMINATION AND PREPARATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
- B. Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify compatibility with and suitability of substrates.
  - 2. Examine roughing-in for mechanical and electrical systems.
  - 3. Examine walls, floors, and roofs for suitable conditions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Take field measurements as required to fit the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
- E. Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- F. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

**3.2 INSTALLATION**

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 3. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations.
- C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

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- D. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed.
- E. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
- F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- G. Use products, cleaners, and installation materials that are not considered hazardous.

### **3.3 CUTTING AND PATCHING**

- A. Provide temporary support of work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- D. Cutting: Cut in-place construction using methods least likely to damage elements retained or adjoining construction.
  - 1. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- E. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in a manner that will minimize evidence of patching and refinishing.
  - 2. Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance.
  - 3. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply



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final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

**3.4 CLEANING**

- A. Clean Project site and work areas daily, including common areas. Dispose of materials lawfully.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
  - 3. Remove debris from concealed spaces before enclosing the space.
  
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:
  - 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - 2. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
  - 3. Remove labels that are not permanent.
  - 4. Clean transparent materials, including mirrors. Remove excess glazing compounds.
  - 5. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean.
  - 6. Vacuum carpeted surfaces and wax resilient flooring.
  - 7. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and foreign substances. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors.
  - 8. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

**3.5 OPERATION AND MAINTENANCE MANUAL PREPARATION**

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  
- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

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1. Prepare supplementary text if manufacturers' standard printed data are unavailable and where the information is necessary for proper operation and maintenance of equipment or systems.
  
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams.

**3.6 DEMONSTRATION AND TRAINING**

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:
  1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.

**END OF SECTION 01 70 00**

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**SECTION 02 41 19 - SELECTIVE DEMOLITION**

**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- A. Items indicated to be removed become property of the contractor. Carefully detach from existing connections, in a manner to prevent damage.
- B. It is not expected that hazardous materials will be encountered in the Work. If hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with EPA regulations and with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

**PART 3 - EXECUTION**

**3.1 DEMOLITION**

- A. Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Before proceeding with demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of the building.
- B. Locate, identify, shut off, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
- C. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- D. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

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- E. Provide temporary weather protection to prevent water leakage and damage to structure and interior areas.
- F. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
- G. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill. Do not burn demolished materials.
- H. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION 02 41 19**

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**SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

A. Submittals:

1. Product Data: For each type of product.
2. Hangers and Supports:
  - a. Shop Drawings: Signed and sealed by a qualified professional engineer.
  - b. Welding certificates.
  - c. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - d. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, and system contents.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

**2.2 HANGERS AND SUPPORTS FOR PLUMBING PIPING EQUIPMENT**

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

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5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.
- C. Fastener Systems:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- D. Miscellaneous Materials:
1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
  2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
    - a. Properties: Nonstaining, noncorrosive, and nongaseous.
    - b. Design Mix: 5000-psi, 28-day compressive strength.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL PIPING INSTALLATIONS**

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.

#### **3.2 HANGERS AND SUPPORTS**

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

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- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.
- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

**END OF SECTION 220529**

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**SECTION 220700 - PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- A. Submittals:
1. Product Data: For each type of product.
  2. For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less according to ASTM E 84.
- B. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less according to ASTM E 84.

**2.2 INSULATION MATERIALS**

- A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.



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1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [CertainTeed Corporation.](#)
    - b. [Johns Manville; a Berkshire Hathaway company.](#)
    - c. [Knauf Insulation.](#)
    - d. [Manson Insulation Inc.](#)
- D. Mineral-Fiber, Preformed Pipe Insulation:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [Fibrex Insulations Inc.](#)
    - b. [Johns Manville; a Berkshire Hathaway company.](#)
    - c. [Knauf Insulation.](#)
    - d. [Manson Insulation Inc.](#)
- DI. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [CertainTeed Corporation.](#)
    - b. [Johns Manville; a Berkshire Hathaway company.](#)
    - c. [Knauf Insulation.](#)
    - d. [Manson Insulation Inc.](#)
- DII. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [Armacell LLC.](#)

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**2.3 ADHESIVES**

- A. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [Aeroflex USA, Inc.](#)
    - b. [Armacell LLC.](#)
    - c. [Foster Brand; H. B. Fuller Construction Products.](#)
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [Childers Brand; H. B. Fuller Construction Products.](#)
    - b. [Eagle Bridges - Marathon Industries.](#)
    - c. [Foster Brand; H. B. Fuller Construction Products.](#)
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. [Childers Brand; H. B. Fuller Construction Products.](#)
    - b. [Eagle Bridges - Marathon Industries.](#)
    - c. [Foster Brand; H. B. Fuller Construction Products.](#)
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less.

**2.4 MASTICS**

- A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

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- a. Foster Brand; H. B. Fuller Construction Products.
  2. For indoor applications, use mastics that have a VOC content of 50 g/L or less.
  3. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  4. Service Temperature Range: Minus 20 to plus 180 deg F.
  5. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  6. Color: White.
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: 60 percent by volume and 66 percent by weight.
  5. Color: White.

## **2.5 SEALANTS**

- A. Joint Sealants for Cellular-Glass Products:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less.

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**2.6 FACTORY-APPLIED JACKETS**

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

**2.7 TAPES**

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.

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4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

### **PART 3 - EXECUTION**

#### **3.1 PIPE INSULATION INSTALLATION**

- A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 078413 "Penetration Firestopping."
- D. Flexible Elastomeric Insulation Installation:
  1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
  2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Mineral-Fiber Insulation Installation:
  1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- F. Polyolefin Insulation Installation:
  1. Seal split-tube longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
  2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of polyolefin pipe insulation. Secure insulation materials and seal seams with

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adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

G. Interior Piping System Applications: Insulate the following piping systems:

1. Domestic hot water.
2. Recirculated domestic hot water.
3. Roof drain bodies and horizontal rainwater leaders of storm water piping.
4. Exposed water supplies and sanitary drains of fixtures for people with disabilities.

H. Do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Sanitary drainage and vent piping.
3. Drainage piping located in crawlspaces unless otherwise indicated.
4. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities.
5. Piping specialties, including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

**END OF SECTION 220700**

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**SECTION 232113 - HYDRONIC PIPING**

**PART 1 - GENERAL**

**1.1 SECTION REQUIREMENTS**

- A. Submittals:
1. Product Data: For each type of product indicated.
  2. For solvent cements and adhesive primers, documentation including printed statement of VOC content.

**PART 2 - PRODUCTS**

**2.1 PIPES, TUBES, AND FITTINGS**

- A. Hard Copper Tubing: ASTM B 88, Type L with ASME B16.22 wrought-copper solder fittings and ASTM B 32, 95-5 tin antimony solder.
- B. Steel Pipe: ASTM A 53, Schedule 40, plain ends with malleable-iron fittings, Class 150 or Class 300.
- C. Unions: ASME B16.39, malleable-iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- D. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure, 250 deg F maximum operating temperature.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded ends.

**2.2 HYDRONIC SPECIALTIES**

- A. Manual Air Vents:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. AMTROL, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett; a Xylem brand.

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- d. Nexus Valve, Inc.
- B. Bronze body and nonferrous internal parts; 150-psig working pressure, 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for seismic restraints.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping free of sags and bends and install fittings for changes in direction and branch connections.
- E. Use the fewest number of joints belowground and within floor slabs.
- F. Install piping at a uniform slope of 0.2 percent upward in the direction of flow.
- G. Make reductions in pipe sizes using eccentric reducer fitting installed with level side up.
- H. Install branch connections to mains using T-fittings in main with takeoff out the bottom of the main, except for up-feed risers, which shall have swing joint and takeoff out the top of the main line.
- I. Install unions in pipes adjacent to each valve, at final connections with each piece of equipment, and elsewhere as indicated.
- J. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- K. Remove stems, seats, and packing of valves and accessible internal parts at piping specialties before soldering or brazing.
- L. Sleeve-Seal-System Installation:
  - 1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.



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2. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand, and make a watertight seal.

**END OF SECTION 232113**

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**SECTION 23 64 16 - VARIABLE SPEED HIGH EFFICIENCY WATER CHILLER**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Chiller package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Chilled water connections.
- E. Condenser water connections.
- F. Starters.
- G. Electrical power connections.
- H. Purge system (where required).

**1.2 RELATED SECTIONS**

- A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

**1.3 REFERENCES AND QUALITY ASSURANCE**

- A. Codes and Standards: Products shall be designed, tested rated and installed in compliance with the following standards, as applicable.
  - 1. ANSI/ASHRAE STANDARD 15-2000/ Safety Code for Mechanical Refrigeration.
  - 2. ANSI/ASHRAE 90.1-1989 Energy-Efficient Design of New Nonresidential & High-Rise Residential Buildings.
  - 3. ASME Boiler and Pressure Vessel Code / Section VIII, Division 1.
  - 4. ARI Standard 550/590-98 Water Chilling Packages Using the Vapor Compression Cycle.
  - 5. ANSI/UL 465 - Central Cooling Air Conditioners
  - 6. AFMBA 9 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have a life of not less than 200,000 hours.
  - 7. ASHRAE Standard 34 - Number Designation and Safety Classification of Refrigerants

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**1.4 SUBMITTALS**

- A. Shop drawing submittals shall include, but not limited to, drawings indicating components, assembly dimensions, weights and loading, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers and thermostatic valves required for complete system.
- B. Submit product data indicating ARI certified rated capacities, weights.
- C. Submit manufacturer's installation instructions.
- D. Submit performance data indicating energy input versus cooling load output from 10% to 100%, in increments of 10% of full load with ARI condenser water relief and minimum entering condenser water temperature at constant design flow.

**1.5 OPERATION AND MAINTENANCE DATA**

- A. Submit operation data.
- B. Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.
- C. Submit maintenance data.
- D. Submit performance data indicating energy input versus cooling load output from 10% to 100%, in increments of 10% of full load at specified and minimum condenser water temperature at constant specified water flow.

**1.6 REFRIGERANT**

- A. Acceptable Refrigerant is HFC-134a only.
- B. All proposals for chiller performance must be certified by ARI and tested per ARI Standard 550/590-98.
- C. An original copy of an ARI Certified computerized selection shall also be provided to display the performance of the machine with the application alternative refrigerant. Capacity and efficiency are to meet the scheduled performance.
- D. If a manufacturer proposes a liquid chiller using HCFC-123, R-514A, or R-1233zd refrigerant, then the manufacturer shall include in the chiller price:
  - 1. A vapor activated alarm system consisting of all alarms, sensors, safeties, and ventilation equipment as required by ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 15 Safety Code for Mechanical Refrigeration (latest edition) with the quotation. System shall be capable of responding to HCFC-123 levels of 10 ppm Allowable Exposure Limit (AEL).
  - 2. A free-standing refrigerant storage tank and pumpout unit shall be provided. The storage vessels shall be designed per ASME (American Society of Mechanical Engineers) Section VIII Division 1 code with 300 psig (2068 kPa) design pressure. Double relief valves per ANSI/ASHRAE 15, latest edition, shall be provided. The tank shall include a liquid level gage and pressure gage. The pumpout unit shall use a semi-hermetic reciprocating compressor with water-

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- cooled condenser. Condenser water piping, 3-phase motor power, and 115-volt control power shall be installed at the jobsite by the installing contractor.
3. Zero emission purge unit capable of operating even when the chiller is not operating.
  4. Back-up relief valve to rupture disk.
  5. Factory-installed chiller pressurizing system to prevent leakage of noncondensables into the chiller during shutdown periods.
  6. Plant room ventilation.
  7. Removal and disposal of refrigerant at the end of the phase out period.
  8. Chillers utilizing a purge unit shall include in the machine price the costs to perform the following regular maintenance procedures:
    - a. Weekly: Check refrigerant charge.
    - b. Quarterly: Charge purge unit dehydrator at least quarterly, more often if necessary. Clean foul gas strainer. Perform chemical analysis of oil.
    - c. Annually: Clean and inspect all valves. Drain and flush purge shell. Clean orifices.

**1.7 SOUND**

- A. SOUND DATA - The Centrifugal Chiller Sound Pressure Level (SPL), in decibels dB), with a reference pressure of 20 micropascals, shall not exceed the value listed in "C" below.
- B. All ratings shall be in accordance with ARI Standard 575-87, "Method of Measuring machinery Sound Within Equipment Rooms."
- C. SOUND LEVEL - Maximum allowable sound level is 84DBA.

**1.8 REGULATORY REQUIREMENTS**

- A. Conform to ARI Standard 550/590-98 for rating and testing of centrifugal chillers.
- B. Conform to UL 465 for construction of centrifugal chillers and provide UL/CUL label.
- C. Conform to ASME Boiler and Pressure Vessel Code / Section VIII, Division 1.
- D. Conform to ASHRAE Standard 15-1994 code for construction and operation of centrifugal chillers.

**1.9 HANDLING AND EQUIPMENT ROOM REQUIREMENTS**

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

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- B. Protect units from physical damage. Leave factory shipping covers in place until installation.
- C. Equipment Room Requirements:
  - 1. Follow minimum standards for refrigeration systems as required by ANSI/ASHREA Standard 15-2000 paying special attention to requirements for air monitoring, ventilation, for leak detection and insuring safety of chiller plant operating personnel.
  - 2. Controls sub-contractor shall provide and install a wall mounted refrigerant monitor that can be calibrated for appropriate refrigerant. Monitor shall not be mounted on or powered from the chiller. There shall be a display on the leak detection unit, in addition to any remote display. Installation have shall include remote lights and horns IAW ASHRAE 15 guidelines.
  - 3. The unit shall utilize infrared, photo-acoustic sensing technology for high precision and reliability. The monitor shall be capable of detecting concentrations of one (1) ppm for low-level leak detection and for insuring the safety of operators. Monitor shall include contacts for connection to refrigerant exhaust system and chiller plant automation system for warnings, alarms and faults. Monitor shall be UL 2075 listed. Acceptable manufacturers are MSA, Genesis, and prior approved alternates.
  - 4. Contacts shall be provided to start the mechanical room purge ventilation system, activate local alarm, and shutdown the chiller in the alarm mode that activate well below the Acceptable Exposure Level (AEL) of the refrigerant and alert persons inside and outside of the equipment room that a leak condition exists.
  - 5. Install local exhaust at relief valve discharge headers and purge units. Route exhaust to the outside of the building and away from all air intakes.

**1.10 WARRANTY**

- A. Warranty: Unit manufacturer shall provide a full parts and labor warranty. Factory employed service technicians shall perform start-up services and labor warranty. Warranty shall include parts and labor for one year after start-up or 18 months from shipment, whichever occurs first. The 2nd- 10.5th Year Extended Parts and Labor Warranty shall be provided by and backed directly by the chiller manufacturer and the chiller manufacturer shall provide an owner certificate for the 10 year extended warranty on each individual unit on the project. All maintenance and analysis required by the extended warranty shall be performed by a contractor of the owners choosing. Warranties that require the owner to purchase a service contract from the manufacturer or manufacturer's service group shall have the cost of the required service contract included in the base bid of the chiller.
- B. SMART Service (System Maintenance Analysis Remote Technology): Chillers shall include a continuous real-time data collection system that uploads the chiller information wirelessly to a cloud based web portal for continuous analysis by the Chiller manufacturer. A detailed monthly report shall be provided to the owner to

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include a summary of chiller component operation, chiller runtime profile, chiller operating efficiency, chiller capacity illustrating peak and average values, heat exchanger performance, and key electrical characteristics.

- C. 2 Year Fully Inclusive Service and Maintenance Contract: A fully inclusive service and maintenance contract shall be included with the chiller purchase for a period of two years from start-up. The service and maintenance contract shall be directly with the factory owned service office of the chiller manufacturer and shall include the following:
1. Operating Inspections: Inspection, logging, and minor adjustments of chiller equipment.
  2. Annual Preventive Maintenance: Includes pre-scheduled recurring annual tasks which may require disassembly.
  3. Seasonal Start-Up: Our cooling or heating start-up service prepares your equipment for seasonal use and optimum performance.
  4. Service Calls (Diagnostics): Service calls and diagnostics by the factory service office.
  5. Repairs & Emergency Service: Parts repair or replacement of maintainable components that have failed unexpectedly are covered (excluding normal wear and tear).
  6. Predictive Maintenance: Uncovers hidden problems before they become an expensive, catastrophic event.
  7. Carrier® SMART Service: This adds improved equipment protection and efficient system operation. Benefits include real-time data collection coupled with the extensive service expertise of Carrier to assess system health.
  8. Planned Maintenance (Overhauls): develop a customized overhaul schedule suitable for each of your major HVAC assets.

## **PART 2 - PRODUCTS**

### **2.1 CHILLER MATERIALS AND COMPONENTS**

- A. General: Factory assembled, single piece, liquid chiller shall consist of compressor, variable frequency drive, lubrication system, cooler, condenser, initial oil and refrigerant operating charges, microprocessor control system, and documentation required prior to start-up. The compressor VFD shall be mounted on the chiller, wired, and tested by the chiller manufacturer. Or, an optional free-standing medium voltage starter or VFD can be wired and tested by the chiller manufacturer.
- B. Provide:
1. Qty(1) 175 ton Carrier 23XRV Chiller
    - a. Full Load Efficiency shall not exceed: 0.5376 kW/tonR
    - b. NPLV shall not exceed: 0.3799 kW/tonR
    - c. Chilled water: 420 gpm

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- d. Chilled water entering temp: 53.97
  - e. Chilled water leaving temp: 44
  - f. Condenser water: 525 gpm
  - g. Condenser water entering temp: 85
  - h. Condenser water leaving temp: 94.21
  - i. Electrical: 460/3/60
2. Qty(1) 225 ton Carrier 23XRV Chiller
- a. Full Load Efficiency shall not exceed: 0.5338 kW/tonR
  - b. NPLV shall not exceed: 0.3554 kW/tonR
  - c. Chilled water: 540 gpm
  - d. Chilled water entering temp: 53.97
  - e. Chilled water leaving temp: 44
  - f. Condenser water: 675 gpm
  - g. Condenser water entering temp: 85
  - h. Condenser water leaving temp: 94.21
  - i. Electrical: 460/3/60
- C. Approved Manufacturers:
- 1. Carrier Corporation 23XRV
- CI. Provide chiller manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer and as required for a complete chiller installation as specified herein. The chiller shall be designed, selected, and constructed to use refrigerant R-134a and meet the capacity requirements specified herein and on the Drawings. Chillers shall consist of, but not limited to, a complete system with compressor, motor, evaporator, condenser, purge system (where required), integral sub-cooler, capacity controller, control panel, motor starter, and other items as specified herein or required.
- CII. Selection: Each chiller shall allow for a waterside fouling factor of 0.0001 in the evaporator tubes and 0.00025 in the condenser tubes. Evaporator and condenser water pressure drops shall not exceed those scheduled on the Drawings. The IPLV/ NPLV rating of chiller supplied shall not exceed the IPLV/NPLV value scheduled on the Drawings. Chillers shall be rated in accordance with the latest edition of ARI Standard 550/590 and shall conform to the latest edition of ASHRAE 15 Safety Code.
- CIII. Efficiency: Chiller full load efficiency shall not exceed 0.538kW/ton. Alternate chiller manufacturer shall submit a factory AHRI certified zero tolerance exceeding the specified full load and part load efficiency of the specified Carrier 23XRV. Chiller IPLV/ NPLV efficiency rating shall be equal to or better than that scheduled. Any deviations from the specified chiller performance shall require a credit given by the chiller manufacture equal or greater to a 30 year life cycle energy differential cost.

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Analysis of the appropriate credit due to the owner shall be performed by the project engineer of record at the expense of the alternate chiller manufacturer.

- G. Chiller shall be capable of extended operation with 55 F entering conde  
temperature to take full advantage of off-design performance.
- H. Specified 175 ton and 225 ton chillers shall be identical and shall only require minor programming from chiller manufacturer service group to be reconfigured in any tonnage between 175 tons and 230 tons. In the 175 ton configuration the RLA shall not exceed 148A and MCA shall not exceed 184A. In the 225 ton configuration, the RLA shall not exceed 177A and MCA shall not exceed 222A.

## **2.2 CONSTRUCTION**

- A. Compressor:
1. One variable speed Tri-Rotor or Magnetic Bearing compressor of the high performance type.
  2. Compressor and motor shall be hermetically sealed into a common assembly and arranged for easy field servicing.
  3. The compressor motor shall be accessible for servicing without removing the compressor base from the chiller. Connections to the compressor casing shall use O-rings and gaskets to reduce the occurrence of refrigerant leakage. Connections to the compressor shall be flanged or bolted for easy disassembly.
  4. Compressor bearings must have individual design life of 50 years or greater when operating at AHRI conditions.
  5. Compressor shall provide capacity modulation from 100% to 15% capacity without the use of hot gas bypass or mechanical unloaders.
  6. Compressor shall be provided with a factory-installed positive pressure lubrication system to deliver oil under pressure to bearings and rotors at all operating conditions. Lubrication system shall include:
    - a. Oil pump with factory-installed motor contactor with overload protection.
    - b. Oil pressure sensor with differential readout at main control center.
    - c. Oil pressure regulator.
    - d. Oil filter with isolation valves to allow filter change without removal of refrigerant charge.
    - e. Oil sump heater [115 v, 50 or 60 Hz] controlled from unit microprocessor.
    - f. Oil reservoir temperature sensor with main control center digital readout.
    - g. All wiring to oil pump, oil heater, and controls shall be pre-wired in the factory and power shall be applied to check proper operation prior to shipment.
  7. Compressor shall be fully field serviceable. Compressors that must be removed and returned to the factory for service shall be unacceptable.
  8. Acoustical attenuation shall be provided as required, to achieve a maximum (full load) sound level, measured per AHRI Standard 575 (latest edition).



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**B. Motor:**

1. Compressor motor shall be of the semi-hermetic, liquid refrigerant cooled, squirrel cage, induction type suitable for voltage shown on the equipment schedule.
2. If an open drive motor is provided, a compressor shaft seal leakage containment system shall be provided.
  - a. An oil reservoir shall collect oil and refrigerant that leaks past the seal.
  - b. A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
  - c. A refrigerant sensor shall be located next to the open drive seal to detect leaks.
3. Motors shall be suitable for operation in a refrigerant atmosphere and shall be cooled by atomized refrigerant in contact with the motor windings.
4. Motor stator shall be arranged for service or removal with only minor compressor disassembly and without removing main refrigerant piping connections.
5. Full load operation of the motor shall not exceed nameplate rating.
6. At least one motor winding temperature sensor (and one spare) shall be provided.
7. Should the mechanical contractor choose to provide a chiller with an open motor instead of the specified semi-hermetic motor, the contractor shall install additional cooling equipment to dissipate the motor heat as per the following formula:
  - 1)  $Btuh = (FLkW \text{ motor}) (0.05) (3413)$
  - 2)  $Btuh = (FLkW \text{ motor}) (171)$
  - 3) and, alternately
  - 4)  $Tons = Btuh / 12,000$
- b. The additional piping, valves, air-handling equipment, insulation, wiring, switchgear changes, ductwork, and coordination with other trades shall be the responsibility of the mechanical contractor. Shop drawings reflecting any changes to the design shall be included in the submittal, and incorporated into the final as-built drawings for the project.
8. Also, if an open motor is provided, a mechanical room thermostat shall be provided and set at 104 F (40 C). If this temperature is exceeded, the chillers shall shut down and an alarm signal shall be generated to the central Energy Management System (EMS) display module prompting the service personnel to diagnose and repair the cause of the over temperature condition. The mechanical contractor shall be responsible for all changes to the design, including coordination with temperature control, electrical and other trades. In addition, the electrical power consumption of any auxiliary ventilation and/or mechanical cooling required to maintain the mechanical room conditions stated above shall be considered in the determination of conformance to the scheduled chiller energy efficiency requirement.

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C. Cooler and Condenser:

1. Cooler shall be of shell and tube type construction, each in separate shells. Units shall be fabricated with high-performance tubing, minimum 1/4 in. (6 mm) steel shell and tube sheets with fabricated steel waterboxes.
  - a. Waterbox shall be nozzle-in-head waterbox (150 psig [1034 kPa]).
  - b. Waterbox shall have standard Victaulic grooves. For 19XR with Frame 6 or Frame 7 compressor, the Victaulic AGS grooves shall be provided for nominal 14-in. pipe and larger.
2. Condenser shall be of shell and tube type construction, each in separate shells. Units shall be fabricated with high-performance tubing, minimum 1/4 in. (6 mm) steel shell and tube sheets with fabricated steel waterboxes.
  - a. Waterbox shall be nozzle-in-head (150 psig [1034 kPa]).
  - b. Waterbox shall have standard Victaulic grooves. For 19XR with Frame 6 or Frame 7 compressor, the Victaulic AGS grooves shall be provided for nominal 14-in. pipe and larger.
3. Waterboxes shall have vents, drains, and covers to permit tube cleaning within the space shown on the drawings. A thermistor type temperature sensor with quick connects shall be factory installed in each water nozzle.
4. Tubes shall be individually replaceable from either end of the heat exchanger without affecting the strength and durability of the tube sheet and without causing leakage in adjacent tubes.
5. Tubing shall be copper, high-efficiency type, with integral internal and external enhancement unless otherwise noted. Tubes shall be nominal 3/4-in. or 1 in. OD with nominal wall thickness of 0.025 in. measured at the root of the fin at the enhanced areas and nominal wall thickness of 0.049 in. where the tubes are in contact with the end tube sheets unless otherwise noted. Tubes shall be rolled into tube sheets and shall be individually replaceable. Tube sheet holes shall be double grooved for joint structural integrity.
6. Cooler shall be designed to prevent liquid refrigerant from entering the compressor.
7. The condenser shell shall include a FLASC (flash subcooler) which cools the condensed liquid refrigerant to a reduced temperature, thereby increasing the refrigeration cycle efficiency.
8. A reseating type pressure relief valve shall be installed on each heat exchanger. If a non-reseating type is used, a backup reseating type shall be installed in series.

D. Refrigerant Flow Control:

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1. To maintain optimal part load efficiency, the refrigerant expansion device to the cooler and as applicable to the economizer, shall use a variable metering valve, such as a float or actuated valve. To ensure good operating performance, the valve design will prevent refrigerant gas from the condenser from passing to the cooler or economizer at full or part load.
  
- E. By maintaining a liquid seal at the flow valve, bypassed hot gas from the condenser to the cooler is eliminated. The float valve chamber shall have a bolted access cover to allow field inspection and the float valve shall be field serviceable.
  
- F. Controls, Safeties, and Diagnostics:
  1. Controls:
    - a. The chiller shall be provided with a factory installed and wired microprocessor control center. The microprocessor can be configured for either English or SI units.
    - b. All chiller and starter monitoring shall be displayed at the chiller control panel.
    - c. The controls shall make use of non-volatile memory.
    - d. The chiller control system shall have the ability to interface and communicate directly to the building control system.
    - e. The default standard display screen shall simultaneously indicate the following minimum information:
      - 1) date and time of day
      - 2) 24-character primary system status message
      - 3) 24-character secondary status message
      - 4) chiller operating hours
      - 5) entering chilled water temperature
      - 6) leaving chilled water temperature
      - 7) evaporator refrigerant temperature
      - 8) entering condenser water temperature
      - 9) leaving condenser water temperature
      - 10) condenser refrigerant temperature
      - 11) oil supply pressure
      - 12) oil sump temperature
      - 13) percent motor rated load amps (RLA)
  
- G. In addition to the default screen, status screens shall be accessible to view the status of every point monitored by the control center including:
  - 1) evaporator pressure
  - 2) condenser pressure
  - 3) bearing oil supply temperature
  - 4) compressor discharge temperature
  - 5) motor winding temperature
  - 6) number of compressor starts

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- 7) control point settings
- 8) discrete output status of various devices
- 9) compressor motor starter status
- 10) optional spare input channels
- 11) current and voltage for each phase
- 12) frequency

H. Schedule Function:

- 1) The chiller controls shall be configurable for manual or automatic start-up and shutdown. In automatic operation mode, the controls shall be capable of automatically starting and stopping the chiller according to a stored user programmable occupancy schedule. The controls shall include built-in provisions for accepting:
  - 2) A minimum of two 365-day occupancy schedules.
  - 3) Minimum of 8 separate occupied/ unoccupied periods per day.
  - 4) Daylight savings start/end.
  - 5) Minimum of 18 user-defined holidays.
  - 6) Means of configuring an occupancy timed override.
  - 7) Chiller start-up and shutdown via remote contact closure.

I. Service Function:

- 1) The controls shall provide a password protected service function which allows authorized individuals to view an alarm history file which shall contain the last 25 alarm/alert messages with time and date stamp. These messages shall be displayed in text form, not codes.

J. Network Window Function:

- 1) Each chiller control panel shall be capable of viewing multiple point values and statuses from other like controllers connected on a common network, including controller maintenance data. The operator shall be able to alter the remote controller's set points or time schedule and to force point values or statuses for those points that are operator forcible. The control panel shall also have access to the alarm history file of all like controllers connected on the network.

K. Pump Control:

- 1) Upon request to start the compressor, the control system shall start the chilled water pump, condenser water pumps and verify that flows have been established.

L. Ramp Loading:

- 1) A user-configurable ramp loading rate, effective during the chilled water temperature pulldown period, shall control the rate of guide

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vane opening to prevent a rapid increase in compressor power consumption. The controls shall allow configuration of the ramp loading rate in either degrees/minute of chilled water temperature pulldown or percent motor amps/minute. During the ramp loading period, a message shall be displayed informing the operator that the chiller is operating in ramp loading mode.

**M. Chilled Water Reset:**

- 1) The control center shall allow reset of the chilled water temperature set point based on any one of the following criteria:
- 2) Chilled water reset based on an external 4 to 20 mA signal.
- 3) Chilled water reset based on a remote temperature sensor (such as outdoor air).
- 4) Chilled water reset based on water temperature rise across the evaporator.

**N. Demand Limit:**

- 1) The control center shall limit amp draw of the compressor to the rated load amps or to a lower value based on one of the following criteria:
- 2) Demand limit based on a user input ranging from 40% to 100% of compressor rated load amps.
- 3) Demand limit based on external 4 to 20 mA signal.

**O. Controlled Compressor Shutdown:**

- 1) The controls shall be capable of being configured to soft stop the compressor. When the stop button is pressed or remote contacts open with this feature active, the guide vanes shall close to a configured amperage level and the machine shall then shut down. The display shall indicate "shutdown in progress."

**2. Safeties:**

a. Unit shall automatically shut down when any of the following conditions occur: (Each of these protective limits shall require manual reset and cause an alarm message to be displayed on the control panel screen, informing the operator of the shutdown cause.)

- 1) motor overcurrent
- 2) over voltage\*
- 3) under voltage\*
- 4) single cycle dropout\*
- 5) bearing oil high temperature
- 6) low evaporator refrigerant temperature
- 7) high condenser pressure
- 8) high motor temperature

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- 9) high compressor discharge temperature
  - 10) low oil pressure
  - 11) prolonged surge
  - 12) loss of cooler water flow
  - 13) loss of condenser water flow
  - 14) starter fault
  - 15) \*Shall not require manual reset or cause an alarm if auto-restart after power failure is enabled.
- b. The control system shall detect conditions that approach protective limits and take self-corrective action prior to an alarm occurring. The system shall automatically reduce chiller capacity when any of the following parameters are outside their normal operating range:
- 1) high condenser pressure
  - 2) high motor temperature
  - 3) low evaporator refrigerant temperature
  - 4) surge prevention control
  - 5) high motor amps.
- c. During the capacity override period, a pre-alarm (alert) message shall be displayed informing the operator which condition is causing the capacity override. Once the condition is again within acceptable limits, the override condition shall be terminated and the chiller shall revert to normal chilled water control. If during either condition the protective limit is reached, the chiller shall shut down and a message shall be displayed informing the operator which condition caused the shutdown and alarm.
- d. Internal built-in safeties shall protect the chiller from loss of water flow. Differential pressure switches shall not be allowed to be the only form of freeze protection.
3. Diagnostics and Service:
- a. A self diagnostic controls test shall be an integral part of the control system to allow quick identification of malfunctioning components.
  - b. Once the controls test has been initiated, all pressure and temperature sensors shall be checked to ensure they are within normal operating range. A pump test shall automatically energize the chilled water pump, condenser water pump, and oil pump. The control system shall confirm that water flow and oil pressure have been established and require operator confirmation before proceeding to the next test. A guide vane actuator test shall open and close the guide vanes to check for proper operation. The operator manually acknowledges proper guide vane operation prior to proceeding to the next test.
  - c. In addition to the automated controls test, the controls shall provide a manual test which permits selection and testing of individual control components and inputs. A thermistor test and transducer test shall display

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and an actual reading shall be performed for each transducer and each thermistor installed on the chiller. All out-of-range sensors shall be identified.

P. Special Features:

1. Sound Insulation Kit Accessory:
  - a. Unit manufacturer shall furnish a sound insulation kit that covers (select):
  - b. The compressor discharge pipe.
  - c. The compressor housing and motor housing.
  - d. The condenser shell and suction line.
  - e. Blanket construction shall allow for installation and removal without the use of tape or caulk. Insulation material shall be 11 lb/cu ft fiberglass. Insulation design shall accommodate temperature and pressure probes, gages, tubing, piping, and brackets. An extended 2-in. wide vinyl flap shall cover all exposed seams, thereby minimizing any potential noise leaks. An aluminum nameplate shall be riveted to each blanket piece. Each tag shall be embossed or etched with lettering indicating piece location, description, size, and tag number sequence.
2. Refrigerant Charge:
  - a. The chiller shall ship from the factory fully charged with R-134a refrigerant and oil.
3. Thermal Insulation:
  - a. Unit manufacturer shall insulate the cooler shell, economizer low side compressor suction elbow, motor shell and motor cooling lines. Insulation shall be 3/4 in. (19 mm) thick with a thermal conductivity not exceeding 0.28 (Btu in.)/hr ft<sup>2</sup> F [(0.0404 • W)/(m • °C)] and shall conform to UL standard 94, classification 94 HBF.
4. Automatic Hot Gas Bypass:
  - a. Hot gas bypass valve and piping shall be factory furnished to permit chiller operation for extended periods of time.
5. Marine Waterboxes, 150 psig (1034 kPa):
  - a. Unit manufacturer shall furnish marine style waterboxes on the condenser rated at 150 psig (1034 kPa).
6. Compressor Discharge Isolation Valve and Liquid Line Ball Valve:
  - a. These items shall be factory installed to allow isolation of the refrigerant charge in the condenser for servicing the compressor.

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7. BACnet Communication Option:
  - a. Shall provide factory-installed communication capability with a BACnet network. Allows integration with i-Vu® Open control system or a BACnet building automation system. (Integration with i-Vu requires the use of the i-Vu Link module for compressor frames 6 and 7. The UPC Open module is required for compressor frames 2-5, E.)
  
8. Unit-Mounted Variable Frequency Drive (VFD):
  - a. Design:
    - 1) VFD shall be refrigerant cooled, microprocessor based, pulse width modulated (PWM) design. Water cooled designs are not acceptable.
    - 2) Output power devices shall be insulated gate bipolar transistors (IGBTs).
    - 3) Converter section with full-wave fixed diode bridge rectifier shall convert incoming fixed voltage/frequency to fixed DC voltage.
    - 4) DC link shall filter and smooth the converted DC voltage.
    - 5) Transistorized inverter and control regulator shall convert fixed DC voltage to a sinusoidal PWM waveform.
    - 6) Integrated controls shall coordinate motor speed and guide vane position to optimize chiller performance over a wide variety of operating conditions.
    - 7) Surge prevention and surge protection algorithms shall take action to prevent surge and move chiller operation away from surge.
  
  - b. Enclosure:
    - 1) Pre-painted, unit mounted NEMA 1 cabinet shall include hinged, lockable doors and removable lifting lugs.
    - 2) VFD shall have a short circuit interrupt and withstand rating of at least 100,000 amps.
    - 3) Provisions to padlock main disconnect handle in the "Off" positions shall be provided. Mechanical interlock to prevent opening cabinet door with disconnect in the "On" position or moving disconnect to the "ON" position while the door is open shall be provided.
    - 4) Provisions shall be made for top entry of incoming line power cables.
  
  - c. Heat Sink:
    - 1) The heat sink shall be refrigerant cooled. Heat sink and mating flanges shall be suitable for ASME design working pressure of 185 psig (1276 kPa).
    - 2) Refrigerant cooling shall be metered by integrated standard controls to maintain heat sink temperature within acceptable limits for ambient temperature.



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- d. VFD Rating:
  - 1) Drive shall be suitable for nameplate voltage  $\pm 10\%$ .
  - 2) Drive shall be suitable for continuous operation at 100% of nameplate amps and 150% of nameplate amps for 3 seconds.
  - 3) Drive shall comply with applicable UL, CE, and NEMA standards.
  - 4) Drive shall be suitable for operation in ambient temperatures between 40 and 104 F (4.4 and 40 C), 95% humidity (non-condensing) for altitudes up to 3300 ft (1006 m) above sea level. Specific drive performance at jobsite ambient temperature and elevation shall be provided by the manufacturer in the bid.
  
- e. User Interface:
  
- f. Displays shall provide interface for programming and display of VFD and chiller parameters. Viewable parameters include:
  - 1) Operating, configuration and fault messages
  - 2) Frequency in hertz
  - 3) Load and line side voltage and current (at the VFD)
  - 4) kW (on the VFD interface)
  
- g. VFD Performance:
  - 1) VFD full load efficiency shall meet or exceed 97% at 100% VFD Rated Ampacity.
  - 2) Displacement Input Power Factor shall meet or exceed 95% soft start, linear acceleration, coast to stop.
  - 3) Base motor frequency shall be either 50 or 60 Hz. Adjustable frequency range from 38 to 60 Hz or 32.5 to 50 Hz.
  
- h. VFD Electrical Service (single point power):
  - 1) VFD shall have input circuit breaker with minimum 100,000 amp interrupt capacity.
  - 2) VFD shall have standard 15 amp branch oil pump circuit breaker to provide power for chiller oil pump.
  - 3) VFD shall have standard 3 kva control power transformer with circuit breaker provides power for oil heater, VFD controls and chiller controls.
  - 4) The branch oil pump circuit breaker and control power transformer shall be factory wired.
  - 5) Input power shall be 380/480 vac,  $\pm 10$  percent, 3 phase, 50/60 Hz,  $\pm 3$  Hz.
  
- i. Discrete Outputs: 115-v discrete contact outputs shall be provided for:
  - 1) Circuit breaker shunt trip

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- 2) Chilled water pump
  - 3) Condenser water pump
  - 4) Alarm status.
- j. Analog Output:
- k. An analog (4 to 20 mA) output for head pressure reference shall be provided. This signal shall be suitable to control a 2-way or 3-way water regulating valve in the condenser piping.
- l. Protection (the following shall be supplied):
- 1) Under-voltage
  - 2) Over voltage
  - 3) Phase loss
  - 4) Phase reversal
  - 5) Ground fault
  - 6) Phase unbalance protection
  - 7) Single cycle voltage loss protection
  - 8) Programmable auto re-start after loss of power
  - 9) Motor overload protection (NEMA Class 10)
  - 10) Motor over temperature protection
- m. VFD Testing:
- n. VFD shall be factory mounted, wired and tested on the chiller prior to shipment

**2.3 FACTORY PROVIDED CHILLED WATER SYSTEM OPTIMIZER PLANT CONTROLLER**

**A. APPROVED PROVIDERS:**

- 1. Automated Logic Corporation Chilled Water System Optimizer
- 2. Carrier Chilled Water System Optimizer

**B. Description: Chiller Water System Optimizer (CWSO)**

- 1. The microprocessor-based chilled water system optimizer (CSWO) shall be provided with a field loadable, factory designed and tested algorithm to optimize the chilled water and condenser water setpoints, improving the operational efficiency of the chilled water plant and associated airside water consuming equipment. The CWSO operates to reduce chiller lift, kw/Ton of the entire chilled water system (producers and consumers) and minimize overall system electrical

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consumption while maintaining comfort and allow the equipment to operate within safe parameters.

2. The chillers in the plant may be screw, type chillers.
  - a. The CWSO supports plants of various sizes.
3. All application software actually performing the required optimization functions shall be pre-tested and pre-configured, and minimizing the need for additional user input.
4. The CWSO controller shall interface to the base networked chiller plant control system via BACnet.
5. The CSWO shall adjust the chilled water and condenser water setpoints based on ambient conditions, plant operational status data and real time measurement of plant and airside equipment electrical consumption, dynamically adjusting for changes in ambient conditions and equipment performance.
6. The CSWO shall include inherent network input and output capability. The input/output capability shall be via:
  - a. BACnet over IP
  - b. BACnet over Ethernet
  - c. MODBUS TCP/IP
  - d. BACnet MSTP
  - e. MODBUS RTU and ASCII
  - f. Carrier CCN (CCN is required to integrate to existing chillers)
7. The CSWO shall function as an overlay to the base plant control system, and not interfere with the plant control systems stand-alone operating or safety algorithms but shall enhance the operation of the plant system by providing optimized chilled water and condenser water setpoints.
8. The CWSO shall be capable of monitoring the electrical consumption of up to:
  - 1) 8 chillers in parallel
  - 2) 40 chilled water primary, secondary and tertiary variable speed pumps
  - 3) 40 variable speed AHU fans serviced by system
  - 4) 20 condenser water pumps
  - 5) 20 cooling towers variable speed fans
9. The CWSO shall have preconfigured, user adjustable operational safeties to limit the chilled water and condenser water setpoints to insure that airside comfort is not negatively, and the chillers are not permitted to surge.
10. The CWSO shall provide support for a system status check to signal the base plant system when the CWSO has gone offline or been disabled by the end user,

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during which time the base plant control system shall revert to its non-optimized setpoints.

C. AAC Attributes

1. The CSWO is an Advanced Application Controller (AAC) which shall be powered from standard, off-the-shelf, Class II, 24-volt transformers. UL-916 (PAZX), cUL-916 (PAZX7), CE, FCC Part 15-Subpart B-Class A.
2. The AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
3. Products shall be manufactured in a facility having a Quality System that is registered to either ISO 9002 or ISO 9001 Quality Assurance Standard.
4. The controller shall be designed to be easily mounted in a standard NEMA 1 type enclosure without special rails or mounting hardware and as local and national code dictates.
5. The controller shall include a 365-day real time clock and status diagnostic indicator provided by a seven segment LED.
6. All configuration data will be stored in nonvolatile memory. The controller shall provide a minimum of two days data retention for the time clock.
7. The controller shall be capable of interfacing to a PC running webserver software for configuring or altering the configuration, setting the address, performing uploads/downloads, etc., through a local interface connector.
8. The CSWO shall support the following network features:
  - a. Trending
  - b. Alarms
  - c. Interface to EMS operators station(s)

D. Network Program Display, Service, and Configuration Screens

1. Dashboard Display : The CWSO shall be provide the following information at the EMS operators station or portable PC:
  - a. CWSO enable/disable status
  - b. Outside Air Temperature
  - c. Outside Air Humidity
  - d. Outside Air Dewpoint
  - e. Outside Air Wetbulb
  - f. Current chilled water supply temperature, setpoint, and optimized setpoint

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- g. Current condenser water supply temperature, setpoint, and optimized setpoint
- h. Summation of instantaneous kW and kw/Ton for all monitored equipment types
- i. Total kW/Ton and kW for the entire chilled water system
- j. Historical kW and kW/H data
  - 1) Today
  - 2) Previous Day
  - 3) Month to Date
  - 4) Previous Month
  - 5) Year to Date
  - 6) Previous Year

2. Properties Screens

- a. Configuration Data: The proposed system shall provide simple, fill-in the blanks configuration screens. The screens shall include all necessary entries with help prompts available for every entry.
- b. Maintenance Data: Maintenance data shall be provided to ease the task of troubleshooting. The screens shall have the capability to display all pertinent data necessary to troubleshoot system operation.

E. Chilled Water System Optimizer Program Requirements

1. Program Enable/Disable:

- a. The CSWO shall have the ability to be enabled manually by the operator through a point available on the properties screen.

F. CSWO System Management Requirements: At the system level, the CSWO shall include the ability to coordinate the operation of the system.

1. Operator Override:

- a. The operator may initiate an override at any time, which shall cause the underlying plant system to revert to its non-optimized setpoints.

G. CHILLED WATER SYSTEM OPTIMIZER SHALL SEEMLESSLY INTEGRATE INTO THE EXISTING AUTOMATED LOGIC WEB CONTROL AND CENTRAL PLANT CONTROLLER

H. USER TOUCH SCREEN INTERFACE: Chilled Water System Optimizer Chiller Controls shall include a NEMA 4 rated 19.5" touch screen, 40" high yoke pedestal mount, and industrial control panel including all control components required to provide a full operational central plant chiller control with touch screen graphical interface and trending. The graphics displayed on the panel shall be remote accessible via

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customers Ethernet or wi-fi connection to any internet browser equipped computer, tablet, or smartphone.

**PART 3 - GENERAL**

**3.1 INSTALLATION**

- A. General: Installing contractor shall install chillers, including components and controls required for chiller operation, in accordance with chiller manufacturer's written instructions and recommendations.
- B. Location: Locate chiller in general position indicated in jobsite drawings. Position chiller with sufficient clearance for normal service and maintenance, including clearance (as suggested by chiller manufacturer) for cleaning and replacement of tubes and motor. If floor mounted starters are supplied in lieu of unit mounted starting devices (if applicable), installing contractor shall be responsible for coordinating the starter location with designer / owner and Division 16 requirements.
- C. Components: Installing contractor shall install auxiliary piping, solenoid valves, shut-off valves, water strainers and controls for accessory systems including, but not limit to, oil cooler (if not factory installed).
- D. Interlock: Installing contractor shall install interlock flow switches with chiller controls in accordance with the manufacturer's instructions.
- E. Refrigerant Relief: Installing contractor shall pipe and install refrigerant relief line as required by codes or as indicated on Drawings. Line size shall be calculated in accordance with ASHRAE 15-1994 Safety Code and governing local codes.
- F. Starter wiring: Installing contractor shall be responsible for the coordination and expense of non-factory mounted starting devices including, but not limited to, all wiring between the starting device and compressor motor.
- G. Electrical Feeder: Installing contractor shall coordinate electrical requirements and connections for all power feeds with Division 16.
- H. Supervision: The unit manufacturer shall supervise the installation and final check-out of the electrical interlock control wiring and review the location of the flow switches.
- I. Insulation: Contractor shall field insulate all cold surfaces [not factory insulated] to prevent condensation. The evaporator shell, end-sheets, water boxes, flow chamber, suction connection, and auxiliary piping shall be coated with flexible, closed-cell plastic type, 3/4" insulation. Water box insulation shall be removable with the water boxes to permit tube cleaning. All chilled water piping and connections shall be insulated as required in Section 15260 of this specification.

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- J. Finish: Installing contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.

**3.2 START-UP SERVICES**

- A. Manufacturer's Supervision: A factory-trained service representative of the manufacturer shall supervise the field-assembly (if any), final installation, pressure testing, checkout, and start-up of each chiller. Prepare manufacturer's written report/log of the installation and start-up signed by the service representative and the Owner.
- B. Representative shall supervise leak testing, evacuation, dehydration, and charging of oil and refrigerant. If any chiller is found to have lost its shipping pressure prior to the time of installation and assembly, then the machine shall be leak tested, and shall be evacuated a minimum of 24 hours. Other special provisions for unit testing and setup as recommended by the equipment manufacturer shall also be followed.
- C. Representative shall instruct the Owner's operating personnel in the operation and service of the units. This instruction shall be concurrent with start-up.
- D. Sustained Operation: Do not place the chiller in sustained operation prior to initial balancing of the mechanical systems affected by chiller operation. Refer to the requirements of Section 15954 [Start-up, Testing, Balancing and Adjusting]. Notify Architect / Engineer prior to chiller start-up.

**3.2 TESTING**

- A. General: Except as otherwise indicated, test chiller in accordance with ARI Standard 550/590-98.
- B. Pressure Test: Conduct a standing pressure test on the refrigerant circuit for a period of 12 hours using nitrogen without exceeding test pressure recommended by the manufacturer. 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 Contractor shall test as indicated. Perform all tests and start-up in such a manner as not to introduce moisture into the machine.

**END OF SECTION 23 64 16**

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**SECTION 236500 - COOLING TOWERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes factory assembled and tested, open circuit mechanical induced-draft vertical discharge cooling tower.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and mounting attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Detail fabrication and assembly of Cooling Towers and Framework that meets or exceeds manufacturers requirements.
  - 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 5. Include diagrams for power, signal, and control wiring.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Product certificates.
- B. Product test reports.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance data.
- B. Operation and maintenance data.



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- C. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Fabricator of products.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code".
- D. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

### **1.6 WARRANTY**

- A. Submit a written warranty executed by the manufacturer, agreeing to repair or replace components of the unit that fail in materials and workmanship within the specified warranty period.
  - 1. Warranty Period: 5 year(s) from date of shipment.
  - 2. Fan Motor/Drive System: Warranty Period shall be Five (5) years from date of unit shipment from Factory (fan motor(s), fan(s), bearings, mechanical support, sheaves, bushings and belt(s)).

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Evapco
  - 2. Baltimore Air Coil
  - 3. Marley/SPX

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## **2.2 PERFORMANCE REQUIREMENTS**

- A. Provide and install (Qty: 3) Evapco AT 19-4J12 CTI Certified Counterflow 316SS Cooling towers with galvanized steel upper (Or equivalent counterflow cooling tower) capable of cooling 2,250 GPM of water from 95F to 85F at 80F entering wet bulb temperature. Product line is CTI/IECC certified. Selection is rated in accordance with CTI standard 201 RS. Each fan cell shall have a 15HP fan motor (maximum HP).

## **2.3 COMPONENTS**

- A. Factory assembled and tested, induced draft counter flow cooling tower complete with fan, fill, louvers, accessories and rigging supports
- B. All cold water basin components including vertical supports, air inlet louver frames and panels up to rigging seam shall be constructed of Type 316 Stainless Steel. All factory cold water basin seams shall be welded for water tight construction. "Series 300" stainless steel shall not be acceptable as equivalent to Type 316 Stainless Steel.
- C. Fan(s) shall be high efficiency axial propeller type with aluminum wide chord blade construction. Each fan shall be dynamically balanced and installed in a closely fitted cowl with venturi air inlet for maximum fan efficiency.
- D. Drift eliminators shall be constructed entirely of Polyvinyl Chloride (PVC) in easily handled sections. Design shall incorporate three changes in air direction and limit the water carryover to a maximum of 0.001% of the recirculating water rate.
- E. Spray nozzles shall be precision molded ABS, large orifice nozzles utilizing fluidic technology for superior water distribution over the fill media. Nozzles shall be designed to minimize water distribution system maintenance. Spray header and branches shall be Schedule 40 Polyvinyl Chloride (PVC) for corrosion resistance with a steel connection to attach external piping.
- F. Fill media shall be constructed of Polyvinyl Chloride (PVC) of cross-fluted design and suitable for inlet water temperatures up to 130° F. The bonded block fill shall be bottom supported and suitable as an internal working platform. Fill shall be self-extinguishing, have a flame spread of 5 under A.S.T.M. designation E-84-81a, and shall be resistant to rot, decay and biological attack.
- G. The air inlet louver screens shall be constructed from UV inhibited polyvinyl chloride (PVC) and incorporate a framed interlocking design that allows for easy removal of louver screens for access to the entire basin area for maintenance. The louver screens shall have a minimum of two changes in air direction and shall be of a non-planar design to prevent splash-out and block direct sunlight & debris from entering the basin.

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- H. Electronic water level control package shall have five (5) stainless steel water level sensors (one (1) high level, one (1) high level alarm, one (1) low level, one (1) low level alarm and one (1) ground) with a NEMA 4x enclosure mounted in a cleanable Schedule 40 PVC external standpipe with slow closing solenoid valve(s) and "y" strainer(s). Wiring is not included and components must be field mounted. Valves shall be sized for 25 psi minimum to 125 psi maximum pressure. Standpipe may require heat tracing by others in cold weather applications.
- I. Pan Strainer(s) shall be all Type 304 Stainless Steel construction with large area removable perforated screens.

## **2.4 MOTORS AND DRIVES**

- A. 15 HP Fan Motor. Motors to be mounted outside of tower outside of the air stream.
- B. Fan motor(s) shall be totally enclosed, ball bearing type electric motor(s) suitable for moist air service. Motor(s) are Premium Efficient, Class F insulated, 1.15 service factor design. Inverter rated per NEMA MG1 Part 31.4.4.2 and suitable for variable torque applications and constant torque speed range with properly sized and adjusted variable frequency drives.
- C. Fan motor(s) shall include strip-type space heaters with separate leads brought to the motor conduit box.
- D. The fan drive shall be multigroove, solid back V-belt type with QD tapered bushings designed for 150% of the motor nameplate power. The belt material shall be neoprene reinforced with polyester cord and specifically designed for evaporative equipment service. Fan sheave shall be aluminum alloy construction. Belt adjustment shall be accomplished from the exterior of the unit.
- E. Fan shaft shall be solid, ground and polished steel. Exposed surface shall be coated with rust preventative
- F. Fan Shaft Bearings shall be heavy-duty, self-aligning ball type bearings with extended lubrication lines to grease fittings located on access door frame. Bearings shall be designed for a minimum L-10 life of 100,000 hours.
- G. Unit shall be provided with a Vibration Cutout Switch, operating on 120 VAC feed, to protect the fan and drive assembly from damage in the event of excess vibration. Vibration switch shall be DPDT.

## **2.5 MAINTENANCE ACCESS**

- A. Access door shall be hinged and located in the fan section for fan drive and water distribution system access. Swing away motor cover shall be hinged for motor access.

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- B. Framed removable louver panels shall be on all four (4) sides of the unit for pan and sump access.
- C. Internal working platform shall provide easy access to the fans, belts, motors, sheaves, bearings, all mechanical equipment and complete water distribution system. The fill shall be an acceptable means of accessing these components.
- D. An external service platform compliant with OSHA shall be provided at the motor access door of the unit extending the full length of the access door. Each platform shall have at least a 36 inch wide walking surface. The platforms shall have galvanized steel grating, supported by galvanized steel framework attached to the unit and surrounded by a handrail, knee rail and toe plate system that is compliant with OSHA. Mounting channels shall be the same material as the casing section (galvanized or stainless steel). A vertical ladder shall be provided from the base of the unit to the platform.

## **2.6 ACCESSORIES**

- A. Cold water basin shall be fitted with copper element, electric immersion heater(s) with a separate thermostat and low water protection device. Heaters shall be selected to maintain +40° F pan water at 0° F ambient temperature.
- B. Cold water basin shall be provided with external connections to equalize basin water levels.
- C. Inlet and outlet connections shall be flanged Class 150#.
- D. Cold water basin shall be provided with bypass connection(s), complete with diffuser hood and sized to accommodate full flow bypass.

## **2.7 CONTROLS AND SAFETIES**

- A. Provide and install Nema 3R control panel with (3) 20HP Emerson H300 VFD's w/bypass, disconnect & fusing for fan circuit. Starters, disconnect, and fusing for basin heaters (1 circuit per tower). Temperature controller and well temperature sensor to modulate VFD to be provided by chiller/controls manufacturer. VFD programming and control panel start-up to be provided by tower manufacturer. Contractor responsible for wiring up 110V-1 electronic water level control. Control wiring from temp sensor to controller, 110V-1 control wiring for basin heaters. 460V-3 power wiring to basin heaters. 460V-3 power wiring to fan motor.

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**2.8 INSTALLATION**

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment.
- B. Comply with NECA 1.

**2.9 STARTUP SERVICE**

- A. Provide factory startup.

**2.10 ADJUSTING**

- A. Commissioning to be provided by installing contractor.

**2.11 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

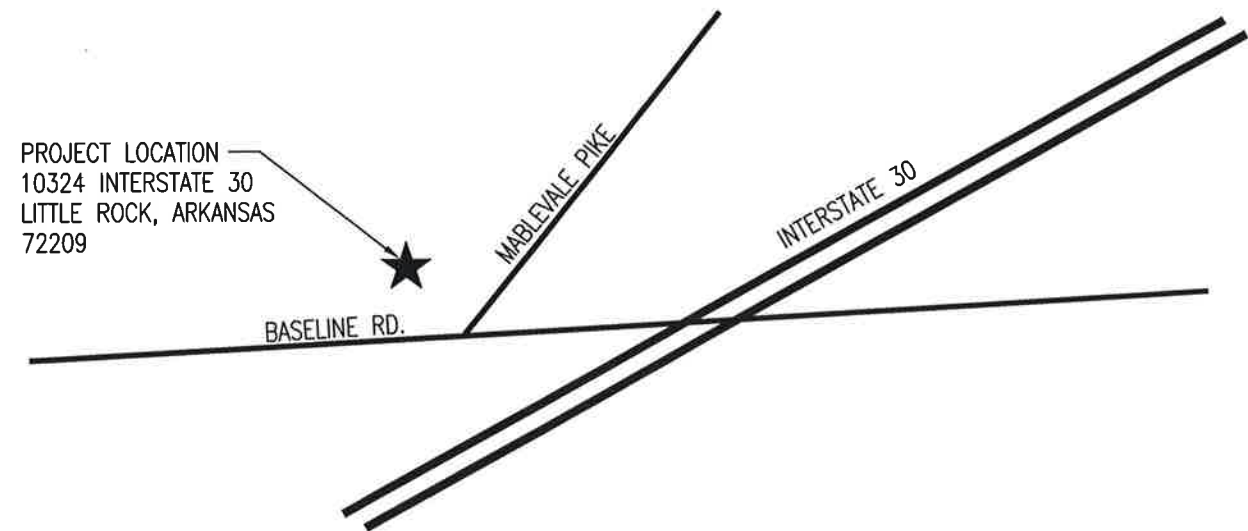
**END OF SECTION**

**ARKANSAS DEPARTMENT OF TRANSPORTATION**  
**CONSTRUCTION PLANS**  
**CENTRAL OFFICE CHILLER**  
**AND COOLING TOWER**  
**REPLACEMENT**  
**PULASKI COUNTY**  
**JOB 42-98**



ARK. HWY. DIST. NO. 6

**CENTRAL OFFICE CHILLER**  
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**REPLACEMENT**  
 Little Rock, Arkansas  
 Pulaski County



**VICINITY MAP**

SCALE : NO SCALE



DATE: JAN. 16, 2017  
**JOB NO: 42-98**  
 DRAWN BY: KB  
 REVISIONS:

**G1.1**

**CENTRAL OFFICE CHILLER  
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 REPLACEMENT**  
 Little Rock, Arkansas  
 Pulaski County



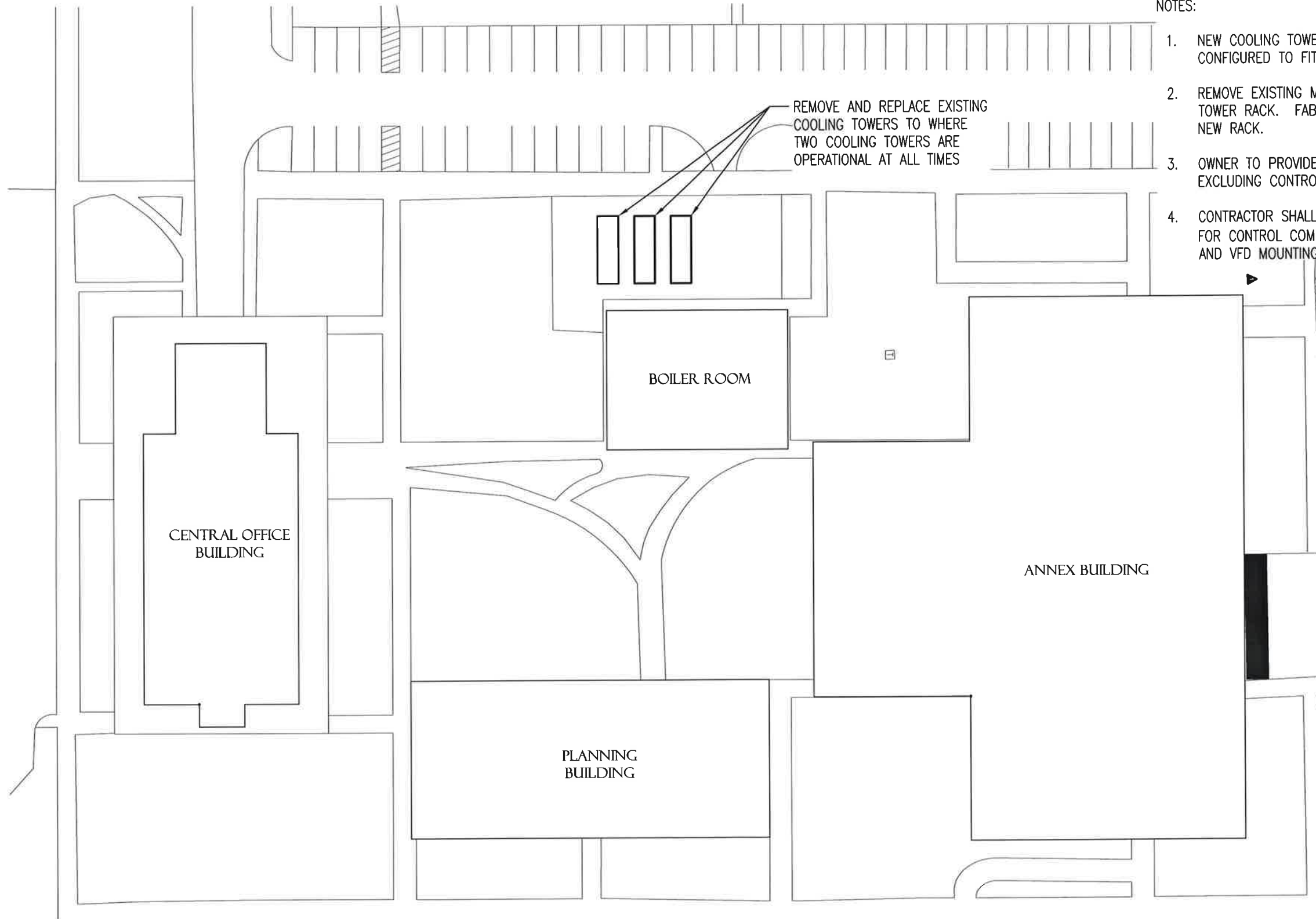
DATE: JAN. 16, 2017  
**JOB NO: 42-98**  
 DRAWN BY: KB  
 REVISIONS:

**M1.1**  
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NOTES:

1. NEW COOLING TOWERS SHALL BE CONFIGURED TO FIT EXISTING PIPING.
2. REMOVE EXISTING METAL COOLING TOWER RACK. FABRICATE AND INSTALL NEW RACK.
3. OWNER TO PROVIDE ELECTRICAL WIRING EXCLUDING CONTROL WIRING.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTROL COMPONENTS/CABINETS AND VFD MOUNTING.

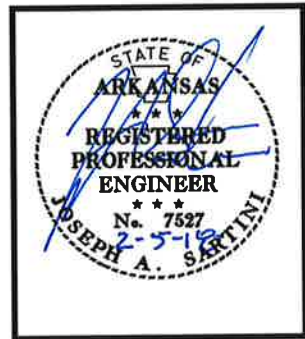
REMOVE AND REPLACE EXISTING COOLING TOWERS TO WHERE TWO COOLING TOWERS ARE OPERATIONAL AT ALL TIMES



 NORTH  M1.1 **SITE PLAN**  
 SCALE: 1" = 50.0'

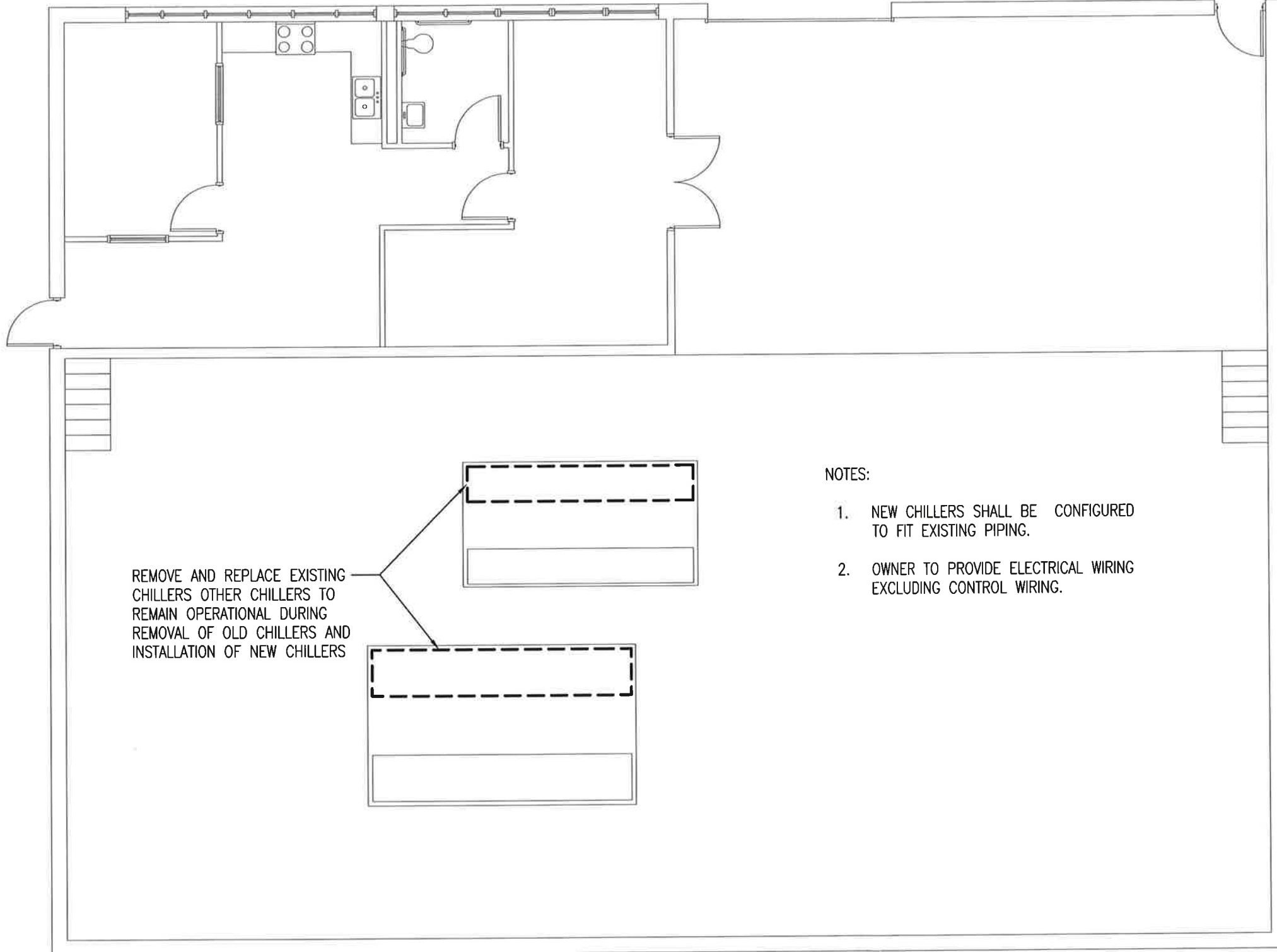


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 Little Rock, Arkansas  
 Pulaski County



DATE: JAN. 16, 2017  
 JOB NO: 42-98  
 DRAWN BY: KB  
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**M2.1**  
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- NOTES:
1. NEW CHILLERS SHALL BE CONFIGURED TO FIT EXISTING PIPING.
  2. OWNER TO PROVIDE ELECTRICAL WIRING EXCLUDING CONTROL WIRING.

REMOVE AND REPLACE EXISTING CHILLERS OTHER CHILLERS TO REMAIN OPERATIONAL DURING REMOVAL OF OLD CHILLERS AND INSTALLATION OF NEW CHILLERS



**1 FLOOR PLAN**  
 M2.1 SCALE: 1/8" = 1'-0"