

CHAMPAIGN COUNTY ADMINISTRATIVE SERVICES

1776 East Washington Street, Urbana, Illinois 61802-4581

*ADMINISTRATIVE, BUDGETING, PURCHASING, & HUMAN RESOURCE
MANAGEMENT SERVICES*

Debra Busey, County Administrator

To: Chair Stan James and the Members of the County Facilities Committee

From: Van A. Anderson, Deputy County Administrator of Finance *V.A.A.*

Subject: ITB 2014-006 Installation of Air-Cooled Chillers at the Brookens Administrative Center

Date: April 11, 2014

cc: Debra Busey, County Administrator
Dana Brenner, Facilities Director

Pods 200 and 300 at the Brookens Administrative Center (Brookens) are served by two air-cooled chillers, both of which are original equipment manufactured in 1986. At approximately 26 years old, these chillers are failing and are scheduled for replacement this year. The chillers each have two of their normal complement of four compressors inoperative due to failures of those compressors. This greatly increases the energy inefficiency of the units. It was determined that since this was a maintenance issue (i.e., direct replacement of the chillers with new similarly-sized equipment), the services of an architectural engineering firm were not necessary. Therefore, instead of a request for qualifications or proposals, an invitation to bid (ITB) was determined to be appropriate.

As Facilities proceeded with the scheduling of the chillers' replacement, options were explored for managing the project, energy efficiency, tie-ins to our green building initiative, and grant funding. The first step in accomplishing this was to initiate an energy model and financial analysis for the Brookens. The energy model, using U.S. Department of Energy's approved software, will allow for a detailed analysis of energy usage and provide the basis for determining payback periods for energy-related projects. It also will provide the information required for seeking grant funding.

There are two firms servicing Champaign County facilities that could provide the needed energy-related services. Those firms are Alpha Controls & Services, L.L.C. (Champaign) and ENTEC Services, Inc. (Peoria). Alpha provides the control technology for the Courthouse while ENTEC provides the control technologies for the Juvenile Detention Center and the Nursing Home. Based on the capabilities demonstrated by those firms in the work done in our facilities, Alpha Controls & Services, L.L.C. was chosen for the pilot project for Brookens. Alpha has initiated the comprehensive analysis at Brookens, provided the information that formed the basis of the ITB for the chiller project, and will work with Facilities to seek grant funding/incentives from the Illinois Department of Commerce and Economic Opportunity (DCEO) for that project. The ITB was written to ensure eligibility for DCEO funding. The maximum eligibility of funding has been determined to be \$19,000.

Chair Stan James and the Members of the County Facilities Committee

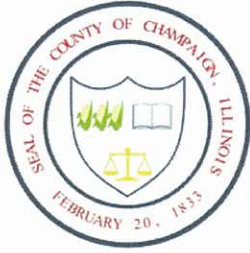
April 11, 2014

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Facilities will work to achieve other cost savings related to the project that also are environmentally friendly. The R-22 refrigerant used in the current chillers is being phased out and its price can vary widely. Facilities will recapture as much of the R-22 refrigerant as possible for use in units at other County facilities.

At this time, the County Facilities Committee is being asked to approve the release of ITB 2014-006 Installation of Air-Cooled Chillers at the Brookens Administrative Center. Funds in the amount of \$318,200 (\$159,100 for each chiller) were allocated to the Capital Asset Replacement Fund for this project this fiscal year.

Van Anderson



CHAMPAIGN COUNTY ADMINISTRATIVE SERVICES

1776 East Washington Street, Urbana, Illinois 61802-4581

*ADMINISTRATIVE, BUDGETING, PURCHASING, & HUMAN RESOURCE
MANAGEMENT SERVICES*

Debra Busey, County Administrator

CHAMPAIGN COUNTY FACILITIES

INVITATION TO BID:

INSTALLATION OF AIR-COOLED CHILLERS AT THE BROOKENS ADMINISTRATIVE CENTER

ITB Number 2014-006

ISSUE DATE: April 17, 2014

BID SUBMITTAL AND OPENING: FRIDAY, May 2, 2014, 2:00 p.m.

BID SUBMITTAL

ITB 2014-006
Champaign County Administrative Services
ATTN: Dana Brenner
Brookens Administrative Center
1776 East Washington Street
Urbana, IL 61802

BID OPENING

Lyle Shields Meeting Room
Brookens Administrative Center
1776 East Washington Street
Urbana, IL 61802

**CHAMPAIGN COUNTY FACILITIES
INVITATION TO BID:
INSTALLATION OF AIR-COOLED CHILLERS
AT THE BROOKENS ADMINISTRATIVE CENTER
ITB 2014-006**

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Section 1 – General Information

1-1 Purpose of the Invitation to Bid for Equipment

The Champaign County Facilities Office (Facilities) announces this invitation to bid (ITB) to solicit bids from responsible vendors to provide for the installation of air-cooled chillers at the Brookens Administrative Center. The specifications to be quoted are found in Section 6 – Specifications beginning on page 16 of this document.

1-2 Internet Access to this ITB

All materials related to the ITB will be available on the Internet at www.co.champaign.il.us/bids. In the event that a potential Respondent does not have download capability, all materials may be obtained from the Champaign County Administrative Services, 1776 East Washington Street, Urbana, IL 61802. Prior to submittal, Respondents shall be responsible for ensuring they have obtained all ITB materials. All Respondents who download the ITB solicitation from our website may e-mail our office at llane@co.champaign.il.us with the subject line “ITB 2014-006” to be registered as a potential Respondent in order to be notified of any clarifications or addenda. Failure to register to receive clarifications and/or addenda shall not relieve the Respondent from being bound by any additional terms and conditions in the clarifications and/or addenda, or from the responsibility of considering additional information contained therein in preparing Respondent’s bid. Any harm to the Respondent resulting from the failure to register and/or ensuring they have obtained all ITB materials shall not be valid grounds for a protest against award(s) made under this solicitation.

1-3 Inquiries and Lobbying Restrictions

Respondents will carefully examine all documents included in this ITB (i.e., this document and any addenda published later) and shall make a written request to the County for interpretation or correction of any ambiguity, inconsistency, or error therein. Any written interpretation or correction will be issued as an Addendum by the County. Only a written interpretation or correction by addendum shall be binding. **Respondents are cautioned against relying upon any interpretation or correction given by any other method.**

All Requests for Interpretation (RFI), correction, or other inquiries concerning the ITB process and/or the subject of this ITB must be directed to:

Dana M. Brenner, Facilities Director
Champaign County Administrative Services
1776 East Washington Street
Urbana, Illinois 61802
PH: 217-384-3776
FAX: 217-384-3896
e-mail: dbrenner@co.champaign.il.us

Except for contact with the designated County official for this ITB, all interested individuals, firms, and their agents who intend to submit or have submitted a proposal or other response to the County are hereby

placed on formal notice that Champaign County Board Members, the Facilities Director, and the Facilities' staff are not to be lobbied, either individually or collectively, concerning this ITB.

Lobbying consists of introduction, discussions related to the bid award process, or any other discussions or actions that may be interpreted as attempting to influence the outcome of the bid award process. This includes holding meetings, engaging in the aforementioned prohibited lobbying and/or prohibited contact, which actions may immediately disqualify Respondent from further consideration by the County for this ITB.

By submitting a bid, the Respondent certifies that it and all of its affiliates and agents have not lobbied or attempted to lobby and Champaign County Board Members, the Champaign County Coroner, or the Coroner's Office staff.

1-4 Addenda

If revisions or clarifications to the ITB become necessary, the County will post written Addenda on its website and notify all registered potential respondents. **However, please note that it is the responsibility of Respondents to closely monitor postings on the County's website (www.co.champaign.il.us/bids).**

The County will not issue Addenda less than five (5) days prior to the scheduled deadline date and time for receiving bids, unless said date is to be postponed.

1-5 Bid Submission and Opening

A bid shall be made in the official name of the agency or individual under which business is conducted (showing the official organization address) and must be signed in ink by a person duly authorized to legally bind the business entity submitting the bid. Champaign County shall not be responsible for unidentified proposals. Respondents are to include all applicable requested information.

To be considered, bids shall include one (1) original and one (1) copy of the bid. Bids may be hand delivered or mailed to:

ITB 2014-006
ATTN: Dana M. Brenner, Facilities Director
Champaign County Administrative Services
1776 East Washington Street
Urbana, IL 61802

The County will not accept nor consider bids submitted by facsimile or e-mail transmission. Respondents mailing their bid must allow a sufficient mail delivery period to ensure timely receipt of their bid. Champaign County is not responsible for bids delayed by mail and/or delivery services of any nature.

Bids shall be accepted until 2:00 p.m. local time on May 2, 2014. Bids received after 2:00 p.m. on May 2, 2014, will not be considered and will be returned to the Respondent unopened. At 2:00 p.m. on that date, the bids will be opened in the Lyle Shields Meeting Room of the Brookens Administrative Center, 1776 East Washington, Urbana, Illinois, and recorded.

1-6 Bid Withdrawal

Respondents may withdraw their bids by notifying the County, in writing, at any time prior to the bid deadline. Respondents may withdraw their bids via e-mail to llane@co.champaign.il.us. Any bid not so withdrawn shall constitute an irrevocable offer for a period of ninety (90) days. Bids, once opened, become the property of Champaign County and will not be returned to the Respondents.

1-7 Bid Disclosure

All bids submitted to the County are subject to the Illinois Compiled Statutes Chapter 5, Section 140 (5 ILCS 140/Freedom of Information Act). At some point after proposal opening, all opened proposals will be made available for public inspection consistent with 5 ILCS 140/Freedom of Information Act.

If a bid is awarded as a result of this ITB, the awarded bid also will become a public record consistent with 5 ILCS 140/Freedom of Information Act. The County has the right to use any or all information/material submitted. Champaign County reserves the right to make an award to the Respondent offering a bid that is deemed in the best interests of Champaign County and meeting all the requirements of this ITB.

1-8 Interviews

Champaign County reserves the right to interview any, all, or none of the respondents in order to clarify their bids.

1-9 Bid Timetable

Champaign County will use the timetable below which is expected to result in the award of the bid on March 20, 2014, and the issuance of a purchase order on March 21, 2014.

<u>Date</u>	<u>Event</u>
April 17, 2014	Invitation to Bid Posted & Advertising Arranged
April 22, 2014	Mandatory Pre-Bid Meeting
April 26, 2014 – Noon	Deadline for Requests for Interpretation or Correction
April 27, 2014	Final Date to Issue Addenda
May 2, 2014 – 2:00 p.m.	Bids Due and Opened – Lyle Shields Meeting Room, Brookens Administrative Center, 1776 East Washington, Urbana, IL 61802
May 6, 2014 – 6:30 p.m.	Facilities Committee – Review of the Bids Evaluation and Recommendation for Award of the Bid with a Notice to Proceed
May 7, 2014	Facilities submittal of the Purchase Requisition and Administrative Services Issuance of the Purchase Order for the Awarded Bid and Notification to all Bidders of the Results of the Award of the Bid
May 22, 2014 – 6:30 p.m.	County Board Consideration and Final Approval

Champaign County may delay or modify scheduled event dates if it is to the advantage of the County to do so. The County will notify Respondents of all changes in scheduled due dates by posting any change in the form of an Addendum on the County's website at www.co.champaign.il.us/bids.

1-10 Acceptance or Rejection of Bids

Each Respondent's bid will be evaluated on its adherence to the equipment specification listed herein meeting the County's requirements and on the price quoted for the equipment.

1-11 Development Costs

Neither the County nor its representatives shall be liable for any expenses incurred by the Respondents in connection with the preparation or submission of a bid in response to this ITB.

1-12 Conflicts of Interest

All Respondents must disclose with their bid the name of any officer, director, or agent who is an elected official, appointed official, or an employee of Champaign County. Furthermore, all Respondents must disclose the name of any elected official, appointed official, or employee of Champaign County who owns directly, or indirectly, any interest in the Respondent's firm or any of its affiliates or branches.

1-13 Non-Collusion

By submitting and signing a proposal response, the Respondent certifies that its bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same materials, services, supplies, or equipment and is in all respects fair and without collusion or fraud. No premiums, rebates, or gratuities are permitted, either with, prior to, or after any delivery of material or provision of services. Any violation of this provision may result in bid cancellation, return of equipment, or discontinuation of services.

1-14 Notice of Award

Notice of Award is expected to be posted on Champaign County's website at www.co.champaign.il.us/bids on May 7, 2014.

Section 2 – Evaluation of Bids

Facilities in cooperation with Administrative Services will evaluate the bids in order to prepare a recommendation to the County Facilities Committee. The County, in its sole discretion, reserves the right to waive all technicalities or irregularities, to reject any or all bids, including any portion thereof, to award the bid to a single Respondent, and to reject all bids and/or re-solicit in whole or in part. The County further reserves the right, in its sole discretion, to award the bid to the Respondent (or Respondents) whose bid best serves the interests of the County.

When a bid appears to contain an obvious error or otherwise where an error is suspected, the circumstances may be investigated and then be considered and acted upon. Any action taken shall not prejudice the rights of the public or other offering entities. Where bids are submitted substantially in accordance with the ITB document but are not entirely clear as to intent or to some particular fact or where there are other ambiguities, clarification may be sought and accepted provided that, in doing so, no change is permitted in prices. The purpose of seeking clarification is to clarify existing information, not to allow additional information to be added.

Section 3 – Selection Process

After Facilities in cooperation with Administrative Services completes the review of the bids, the recommended bid for award will be submitted to the County Facilities Committee for award of the bid with a Notice to Proceed. Upon their review and concurrence, the County Facilities Committee will forward the recommendation for award of the bid to the full Champaign County Board for consideration and final approval. All respondents will be notified of the award of the bid by the Champaign County Facilities.

The County reserves the right to terminate this ITB solicitation at any stage if Facilities and/or the Administrative Services Department determine this action to be in the County's best interests. The receipt of Bids or other documents will in no way obligate Champaign County to award the bid.

Section 4 - Additional Details of the Process

4-1 Addenda

If it becomes necessary to revise or expand upon any part of this ITB, an addendum will be sent to all of the prospective Respondents registered with the County prior to the bid due date. Prospective Respondents are automatically listed when they e-mail Administrative Services as documented in Section 1-2 upon download of the ITB information. Each addendum is incorporated as part of the ITB documents and posted at www.co.champaign.il.us/bids.

The addendum may include, but will not be limited to, responses to questions and requests for clarification sent to the Facilities Director according to the provisions of Section 1-3 herein.

4-2 County's Rights to Reject Bids

If no Respondent's bid is selected through this ITB process, then the Administrative Services Department may utilize any other procurement method available to Champaign County, to obtain the equipment described herein.

In soliciting bids, any and all bids received may be rejected in whole or in part. Basis for rejections shall include, but not be limited to the following:

- The bid being deemed unsatisfactory as to quantity, quality, delivery, price, or service offered.
- The proposal not complying with conditions of the ITB document or with the intent of the ITB.
- Lack of competitiveness by reason of collusion or knowledge that reasonably available competition was not received.
- Error in specifications or indication that revision would be to the County's advantage.
- Regulatory changes.
- Circumstances which prevent determination of the most advantageous bid.
- Any determination that rejection would be in the best interest of the County.

Champaign County reserves the right to reject any and all proposals. The County also reserves the right to cancel this ITB at any time and/or to solicit and re-advertise for other bids.

4-3 No Liability for Costs

The County is not responsible for costs or damages incurred by Respondents, member(s), partners, subcontractors, or other interested parties in connection with the ITB process, including but not limited to costs associated with preparing the bid and/or participating in any conferences, site visits, product/system demonstrations, oral presentations, or negotiations.

Section 5 – Scope of Work

Installation of Air-Cooled Chillers, subject to continuing need and availability of funds. Bid per specifications contained herein.

SCHEDULE OF EVENTS

Payment will be processed after receipt of delivery invoice and appropriate affidavit.

NON-DISCRIMINATION

Contractor shall comply with the Illinois Human Rights Act, 775 ILCS 5/1-101 et seq., as amended and any rules and regulations promulgated in accordance therewith, including, but not limited to the Equal Employment Opportunity Clause, Illinois Administrative Code, Title 44, Part 750 (Appendix A), 775 ILCS 5/1-102, which is incorporated herein by reference, and constituting of a written EEO Policy and a workforce profile that demonstrates its EEO practices. Furthermore, the Contractor shall comply the Public Works Employment Discrimination Act, 775 ILCS 10/0.01 et seq., as amended. The Contractor must have a written sexual harassment policy, which meets Illinois State Statutes, 775 ILCS, 15/3.

PREVAILING WAGE

The State of Illinois requires that all wages paid by the Contractor and each subcontractor shall be in compliance with The Prevailing Wage Act (820 ILCS 130), as amended. This requires payment of the general prevailing rate for each craft or type of worker, including payment of the general prevailing rate for legal holiday and overtime work. The Illinois Department of Labor publishes the prevailing wage rates on its website at www.state.il.us/agency/idol/rates.htm. The Contractor shall review the wage rates applicable to the work of the contract at regular intervals in order to ensure the timely payment of current wage rates. The Contractor agrees that no additional notice is required. The Contractor shall be responsible to notify each subcontractor of the wage rates set forth in this contract and any revisions thereto. A copy of the prevailing wage rates is posted on the Champaign County website at www.co.Champaign.il.us. If wage rates change during the course of the project, the new rates will be available in the County of Champaign Purchasing Office. Vendors may access the Illinois Department of Labor website for updates www.state.il.us/agency/idol.

CERTIFIED PAYROLL REQUIREMENTS (Public Act 94-0515)

Effective August 10, 2005 contractors and subcontractors on public works projects must submit certified payroll records on a monthly basis to the public body in charge of the construction project, along with a statement affirming that such records are true and accurate, that the wages paid to each worker are not less than the required prevailing rate and that the contractor is aware that filing records he or she knows to be false is a Class B misdemeanor. The certified payroll records must include for every worker employed on the public works project the name, address, telephone number, social security number, job

classification, hourly wages paid in each pay period, number of hours worked each day, and starting and ending time of work each day. These certified payroll records are considered public records and public bodies must make these records available to the public under the Freedom of Information Act, with the exception of the employee's address, telephone number and social security number. Any contractor who fails to submit a certified payroll or knowingly files a false certified payroll is guilty of a Class B misdemeanor.

INCREASED PENALTIES FOR PREVAILING WAGE VIOLATIONS (Public Act 94-0488)

Effective January 1, 2006, penalties for violations of the Prevailing Wage Act will increase from 20% to 50% of the underpaid amounts for second or subsequent violations. An additional penalty of 5% of the underpayment penalty must be paid to workers for each month the wages remain unpaid (up from the current 2% penalty). For violations that occur after January 1, 2006, the debarment period --during which contractors are ineligible for public works contracts -increases from 2 years to 4 years if two notices of violation are issued/serious violations occur within a 5-year period. In addition, a new monetary penalty of \$5,000 may be assessed against contractors who retaliate against employees who report violations or file complaints under the Prevailing Wage Act.

OSHA REQUIREMENTS

The Occupational Safety and Health Act of 1970 (OSHA) “guarantees workers the right to a safe and healthful workplace”. Under Section 5(a) (1) of the OSHA Act, the employer must “furnish to each of his employees’ employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees.” There are times when the County must hire entities and individuals (contractors) to perform services. To this end, contractors hired by the County of Champaign must perform their duties in a manner that is compliant with all state and federal health and safety laws and industry guidelines. It is the responsibility of the contractor to ensure that their personnel and subcontractors comply with all state and federal health and safety laws and regulations and industry guidelines, including, but not limited to those set forth by: OSHA and related regulations, the Safety Inspection and Education Act, the Health and Safety Act, the National Institute of Occupational Safety and Health, the National Fire Protection Association, the Centers for Disease Control, American Industrial Hygiene Association, the American Council of Governmental Industrial Hygienists, the Environmental Protection Agency, and the Department of Transportation.

SUBSTANCE ABUSE PREVENTION ON PUBLIC WORKS PROJECTS ACT

The successful bidder must be in compliance with State of Illinois HB-1855 (Public Act 095-0635), which amends the Prevailing Wage Act. Before an employer commences work on a public works project, the employer shall have in place a written program, which meets or exceeds the program requirements in this Act, to be filed with the public body engaged in the construction of the public works and made available to the general public, for the prevention of substance abuse among its employees. The testing must be performed by a laboratory that is certified for Federal Workplace Drug Testing Programs by the Substance Abuse and Mental Health Service Administration of the U.S. Department of Health and Human Services.

PROCUREMENT OF GREEN PRODUCTS AND TECHNOLOGIES

As approved by the Champaign County Board in April 2008, it is in the interest of public health, safety and welfare and the conservation of energy and natural resources to use and promote environmentally responsible products. The County should strive to influence private purchases through the example of

using government specifications and standards that are green or environmentally friendly when making its purchases.

Whenever available and cost-justified, the County should purchase those materials including the purchase of recycled products containing post-consumer materials rather than residual materials resulting from the processing or manufacturing from another product. To the extent practicable, all products standards shall emphasize functional or performance criteria, which do not discriminate against the use of, recycled materials. Champaign County should cooperate to the greatest extent feasible with other governments and organizations to develop a comprehensive, consistent, and effective procurement effort intended to stimulate the market for recycled products, reusable products, products designed to be recycled, and other environmentally responsible products. Champaign County shall continue to participate in and shall encourage other public jurisdictions to participate with the County in the purchase of products containing recycled content. Participation in such cooperative systems shall be aimed at obtaining maximum practical recycled content in County purchases, to obtain best available price for products with recycled content, to facilitate or encourage lower prices industry-wide and to encourage development of industries and markets dealing with recycled content products.

PROCUREMENT OF PRODUCTS THAT ARE ENERGY STAR QUALIFIED

Champaign County shall select, where life cycle and cost-effective, ENERGY STAR and other energy efficient products, when acquiring energy-using products. This information will be required by the bidder in their bid submittal.

SECURITY

The contractor represents and warrants to the County of Champaign that neither it nor any of its principals, shareholders, members, partners or affiliates, as applicable, is a person or entity named as a Specially Designated National and Blocked Person (as defined in Presidential Executive Order 13224) and that it is not acting, directly or indirectly, for or on behalf of a Specially Designated National and Blocked Person. The Contractor further represents and warrants to the County of Champaign that the Contractor and its principals, shareholders, members, partners, or affiliates, as applicable, are not directly or indirectly, engaged in, and are not facilitating, the transactions contemplated by this Agreement on behalf of any person or entity named as Specially Designated National and Blocked Person. The Contractor hereby agrees to defend, indemnify and hold harmless the County of Champaign, the Corporate Authorities, and all County of Champaign elected or appointed officials, officers, employees, agents, representatives, engineers and attorneys, from and against any and all claims, damages, losses, risks, liabilities, and expenses (including reasonable attorneys' fees and costs) arising from or related to any breach of the foregoing representation and warranties.

PURCHASE EXTENSION

This contract shall be offered for purchases to be made by other counties and governmental units within the State of Illinois as authorized by the Government Joint Purchasing Act. All purchases and payments made under this authority shall be made directly by the governmental unit to the Vendor. The County of Champaign shall not be responsible in any way for such purchase orders or payments. All terms and conditions of this contract shall apply to all orders placed by another governmental unit.

ADDENDUM

Should the Vendor require any additional information about this Bid, please submit your Request for Information per the instructions in 1-3 above. ANY AND ALL changes to these specifications are valid

only if they are included by Written Addendum to All Bidders. NO interpretation of the meaning of the plans, specifications, or other contract documents will be made orally. If required, all addenda will be faxed to bidder if a Notice of Intent to Bid has been sent via e-mail to llane@co.champaign.il.us as indicated in 1-2 above. In addition, all addenda are posted on the County of Champaign's website at www.co.champaign.il.us/bids. Failure of the bidder to receive any such addendum or interpretation shall not relieve the bidder from obligation under this Bid as submitted. All addenda so issued shall become part of the bid documents. Failure to request an interpretation constitutes a waiver to later claim that ambiguities or misunderstandings caused by a bidder to improperly submit a bid.

Response to these questions will be made by means of an addendum. Only the Facilities Director has the authority to issue an addendum.

Addenda are written instruments issued by the County prior to the date for receipt of proposals, which modify or interpret the Bid by addition, deletions, clarifications or corrections.

Prior to the receipt of bids, addenda will be faxed or delivered to all who are known to have received a Notice to Bid. Each vendor shall ascertain prior to submitting a bid that all addenda issued have been received and, by submission of a bid, such act shall be taken to mean that such vendor has received all addenda and that the vendor is familiar with the terms thereof and understands fully the contents of the addenda.

TAXES

The County of Champaign is exempt from paying Illinois Use Tax, Illinois Retailers Occupation Tax, and Federal Excise Tax. The bidder's attention is directed to the Champaign County Purchasing Ordinance {S3-10, (9), (10), and(11)}.

INSURANCE

(1) GENERAL The successful bidder shall maintain for the duration of the contract and any extensions thereof, at bidder's expense, insurance that includes "Occurrence" basis wording and is issued by a company or companies qualified to do business in the State of Illinois that are acceptable to the County, which generally requires that the company(ies) be assigned a Best's Rating of A or higher with a Best's financial size category of Class XIV or higher, in the following types and amounts:

(a) Commercial General Liability in a broad form, to include, but not limited to, coverage for the following where exposure exists: Bodily Injury and Property Damage, Premises/Operations, Independent contractors, Products/Completed Operations, Personal Injury and Contractual Liability; limits of liability not less than: \$500,000 per occurrence and \$1,000,000 in the aggregate;

(b) Business Auto Liability to include, but not be limited to, coverage for the following where exposure exists: Owned Vehicles, Hired and Non-Owned Vehicles and Employee Non-Ownership; limits of liability not less than: \$300,000 per occurrence, combined single limit for: Bodily Injury Liability and Property Damage Liability;

(c) Workers' Compensation Insurance to cover all employees and meet statutory limits in compliance with applicable state and federal laws. The coverage must also include Employer's Liability with minimum limits of \$100,000 for each incident.

(2) EVIDENCE OF INSURANCE The successful bidder agrees that with respect to the above required insurance that:

(a) The County of Champaign shall be provided with Certificates of Insurance evidencing the above required insurance, prior to commencement of the contract and thereafter with certificates evidencing renewals or replacements of said policies of insurance at least fifteen (15) days prior to the expiration or cancellation of any such policies;

(b) The contractual liability arising out of the contract shall be acknowledged on the Certificate of Insurance by the insurance company;

(c) The County of Champaign shall be provided with thirty (30) days prior notice, in writing, of Notice of Cancellation or material change and said notification requirement shall be stated on the Certificate of Insurance;

(d) Subcontractors, if any, comply with the same insurance requirements. In addition to being named as an additional insured on the Certificate of Insurance, each liability policy shall contain an endorsement naming the County of Champaign as an additional insured. A copy of the endorsement shall be provided to Champaign County along with the Certificate of Insurance; and,

(e) Have Champaign County named as an additional insured and the address for certificate holder must read exactly as: County of Champaign, a **body politic** 1776 East Washington Street, Urbana, IL 61802

(f) Insurance Notices and Certificates of Insurance shall be provided to: Champaign County, Deputy County Administrator of Finance, Administrative Services Department, 1776 East Washington Street, Urbana, IL 61802

HOLD HARMLESS CLAUSE

The successful bidder will agree to indemnify, save harmless and defend the County of Champaign, its agents, servants, and employees, and each of them against and hold it and them harmless from any and all lawsuits, claims, demands, liabilities, losses and expenses, including court costs and attorney's fees, for or on account of any injury to any person, or any death at any time resulting from such injury, or any damage to property, which may arise or which may be alleged to have arisen out of or in connection with the work covered by this contract upon award. The foregoing indemnity shall apply except if such injury, death or damage is caused directly by the willful and wanton conduct of the County of Champaign, its agents, servants, or employees or any other person indemnified hereunder.

BID RESPONSE

It is highly recommended that the vendor completely read the bid prior to filling out to become acquainted with terms and conditions of the bid document and merchandise requirements. No relief will be allowed from the bid conditions unless you take written exception to that condition on your bid. **BIDS MUST BE SUBMITTED IN DUPLICATE FORM, (One Original, and One Copy). BIDS ARE DUE BACK BY 2:00 P.M. (CDT) ON May 2, 2014. SEALED BID ENVELOPES ARE TO BE CLEARLY MARKED WITH: ITB 2014-006.**

Bidders are urged to respond to this bid request in every case to insure being maintained on current bid lists. Explanations of the reasons for not bidding will assist in maintaining the bidder on the correct bid list(s).

SUBMITTAL

Submit one (1) bid, multiple bids will not be accepted.

GENERAL CONDITIONS

This bid shall be firm for at least 120 days after the latest time specified for submission for bids and thereafter until written notice is received from the bidder.

AWARD OF ORDER

The County will award a purchase order to the lowest responsive, responsible bidder meeting the County's requirements as listed in this document. The County will be the sole judge of acceptability of any products offered.

WORKMANSHIP

Items shall be manufactured according to the highest traditions of the industry and shall meet all commercial standards of quality. The County shall be the sole judge of acceptable products. Unacceptable products will be rejected and suitable price adjustments made.

MISCELLANEOUS

It is the bidder's task to be familiar with the referenced items and to offer only products of equal or greater quality. Any questions on specifications should be directed to the Purchasing Department.

EXCEPTIONS

The bid speaks for itself. Bidders taking exception to any terms, conditions or specifications of this bid must clearly state in writing such exception(s) either on or with their bid. The County will be the sole judge of the acceptability of any exception noted, and is not bound to consider any bid submitted with exceptions.

ALTERNATES

Trade names are used solely for the purpose of setting minimum standards of quality and performance and are not to be construed as exclusionary. Bidders are encouraged to contact the Purchasing Department prior to the bid opening for the purpose of clarifying specifications.

FULL PRICING AND CONTINGENCIES

The County shall hold the successful bidder to bid pricing. Additional charges for contingencies discovered by the vendor at any time after the date of opening of this bid will not be considered for payment by the County.

RECOURSE FOR UNSATISFACTORY MATERIALS

Payment shall be contingent upon the County's inspection of and satisfaction with completed work. Any defective work or materials, non-conformance to bid specifications, damaged materials, or unsatisfactory installation shall be corrected to the County's satisfaction by the successful bidder at no additional charge.

TERMINATION

Failure to comply with the terms and conditions as herein stated shall be cause for cancellation of the contract. The County will give written notice of unsatisfactory performance and the contractor will be allowed thirty (30) days to take corrective action and accomplish satisfactory control. If at the end of the thirty days, the County deems the contractor's performance still unsatisfactory, the contract shall be canceled. The exercise of its right of cancellations shall not limit the County's right to seek any other remedies allowed by law.

The successful bidder will agree that the resulting contract is made subject to available budgetary appropriations and shall not create any obligation on behalf of the County in excess of such appropriations. In the event that no funds or insufficient funds are appropriated and budgeted, this Contract shall terminate without penalty or expense to the County thirty (30) days after written notification of termination from the County.

The successful bidder will agree that pursuant to requirements imposed under Illinois law, the County shall have 120 days after each election of county board members to terminate this Agreement, without cause and without penalty.

CHOICE OF LAW AND VENUE

The bidder agrees that this bid has been executed and delivered in Illinois and that their relationship and any and all disputes, controversies or claims arising under this bid or any resulting contract shall be governed by the laws of the State of Illinois, without regard to conflicts of laws principles. The bidder further agrees that the exclusive venue for all such disputes shall be the Circuit Court of the 22nd Judicial Circuit of Champaign County, Illinois, and the bidder hereby consent to the personal jurisdiction thereof.

REJECTION OF BIDS, WAIVER OF IRREGULARITIES

Champaign County reserves the right to reject any or all bids, to waive irregularities, and to accept that bid which is considered to be in the best interest of the County. Any such decision shall be considered final.

PROTEST PROCEDURES

Any Bidder who believes contractual terms or specifications are unnecessarily restrictive or limit competition may submit a protest, in writing, to the Deputy County Administrator of Finance, Administrative Services Department, 1776 East Washington Street, Urbana, IL 61802. To be considered, the protest must be received by Champaign County five (5) days prior to the stated bid opening. Any adversely affected or aggrieved Bidder shall have ten (10) days from the date of the bid opening to file a written protest regarding the intent to award the bid. Protests submitted after that date will not be accepted. Protests must specify the grounds upon which the protest is based (refer to appropriate statute, rule, code, or ordinance which defines the protest process).

BIDDER'S ATTACHMENT TO THE BID

Any attachment to this bid, as required by the bid conditions, or made at the bidder's option, must reference on their face the bid title, opening date, and time.

DELIVERY

Delivery will be considered in making the award and the bidders shall state, in the spaces provided, expected delivery after receipt of Purchase Order. Failure to meet said delivery promises without prior consent of the Deputy County Administrator of Finance will be considered a breach of faith.

FREIGHT

Freight is all inclusive unless otherwise stated.

FUEL SURCHARGE

The County of Champaign does NOT accept any fuel surcharges.

Section 6 - SPECIFICATIONS

Please refer to the following pages (Chiller Replacement Plans, Project Manual and Exhibit A) for complete specifications.

In addition, by submitting this Bid, Bidder represents that:

- Bidder **HAS VISITED THE SITE, during the MANDATORY PRE-BID MEETING**, (as shown in the BID SCHEDULE) and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress and performance of the Work.
 - Bidder has examined and carefully studied the Bidding Documents and the other related data identified in the Bidding Documents. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
 - Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
 - The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
 - Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.
 - This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation.
 - Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid. Bidder has not solicited or induced any individual or entity to refrain from bidding.
 - Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.
 - The Bidder must be able to demonstrate recent successful completion of similar projects on similar building types. The County may ask the bidder to supply a list of these projects along with the names of the owner's rep for reference. This supporting documentation will be requested prior to PO issuance. Failure to demonstrate this qualification will result in the disqualification of the bid.
 - Equipment pre-purchased by Owner will be assigned to the successful contractor so that, once selected, that contractor becomes (1) responsible for coordination of the installation and (2) the single construction and warranty period contact for the project thereafter.
- * **Project Schedule: Bidder shall commit to having substantial completion including startup and availability of the chillers for cooling no later than August 1, 2014. Bidders shall specify in their bid a substantial completion date that they can meet which is on or before August 1, 2014.**
- ****Subcontractors: BIDDER MUST INCLUDE IN SUBMITTAL, THE SUBCONTRACTORS TO BE UTILIZED.**

SPECIFICATIONS DIVISION 01 -GENERAL REQUIREMENTS

SPECIFICATIONS

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 3103 STARTING OF SYSTEMS
SECTION 01 3300 SUBMITTALS
SECTION 01 4000 QUALITY CONTROL SERVICES
SECTION 01 6000 MATERIAL AND EQUIPMENT

DIVISION 20 – COMMON REQUIREMENTS FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION

SECTION 20 0500 BASIC REQUIREMENTS FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION
SECTION 20 0519 METERS AND GAUGES FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION

SECTION 20 0529 HANGERS AND SUPPORTS FOR MECHANICAL, PLUMBING AND FIRE
 SUPPRESSION SYSTEMS

SECTION 20 0700 THERMAL INSULATION FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION

DIVISION 23 -MECHANICAL

SECTION 23 0100 COMMON WORK REQUIREMENTS FOR MECHANICAL
SECTION 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
SECTION 23 0900 BASIC TEMPERATURE CONTROL REQUIREMENTS
SECTION 23 2113 HYDRONIC PIPING AND SPECIALTIES
SECTION 23 2500 PIPE CLEANING, FLUSHING, AND CHEMICAL TREATMENT
SECTION 23 6423 AIR-COOLED LIQUID CHILLERS

SECTION 01 3103 STARTING OF SYSTEMS

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Starting systems
- B. Demonstration and instructions
- C. Testing, adjusting and balancing

1.2 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Engineer and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Verify utilities, connections and controls are complete and equipment is in operable condition.
- G. Observe start-up and adjustments: Record time and date of start-up and results.
- H. Observe equipment demonstrations to Owner: Record times and additional information required for Operation and Maintenance Manuals.
- I. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers' instructions.
- J. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up and to supervise placing equipment or system in operation.
- K. Submit a written report in accordance with Division 01 Section 01 400, "Quality Control Services," that equipment or system has been properly installed and is functioning correctly.

1.3 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstration and instructions shall be provided by a qualified manufacturers' representative who is knowledgeable about the Project.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance and shutdown of each item of equipment at agreed-upon times, at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.4 INSPECTION AND ACCEPTANCE OF EQUIPMENT

- A. Prior to inspection, verify that equipment is tested, operational and clean.
- B. Assist Engineer with inspection. Prepare list of items to be completed and corrected.

1.5 TESTING, ADJUSTING AND BALANCING

- A. The independent firm will perform services specified in Division 23 Section 23 0593, "Testing, Adjusting, and Balancing for HVAC," except for factory tests.
- B. Reports will be submitted by the independent firm to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.6 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

Not Applicable

END OF SECTION

SECTION 01 3300 SUBMITTALS

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures
- B. Proposed products list
- C. Contractor-prepared shop drawings
- D. Preventive maintenance (PM) tasks/schedule
- E. Product data
- F. Samples
- G. Manufacturer's instructions
- H. Manufacturer's certificates

1.2 SUBMITTAL PROCEDURES

- A. Refer also to provisions of the General Conditions.
- B. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet, equipment tag, system designation number(s) and specification Section number, as appropriate.
- C. Where possible, submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal so long as this does not delay individual items whose review is time-critical.
- D. If only part of required drawings in one group are submitted, action will be withheld on them until remaining drawings are submitted.
- E. Catalog cuts showing more than one model of a product shall be clearly marked indicating which model is being proposed.
- F. Capacity and performance data shall be given in same form, units and completeness presented in Contract Documents.
- G. Identifying symbols and tags used on drawings shall be clearly cross-referenced on shop drawings.
- H. Identify room names and numbers in which various products will be used.
- I. Schedule submittals to expedite the Project and deliver to Engineer at business address. Electronic submittals are also acceptable.
- J. Mark in units to match those specified.
- K. Provide space for Contractor and Engineer review stamps.
- L. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- M. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

- N. Revise and resubmit submittals as required, identifying all changes made since previous submittal.
- O. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit estimated progress schedule in duplicate within 10 days after date of Owner-Contractor Agreement established in Notice to Proceed] for Engineer review.
- B. Revise and resubmit as required.
- C. Revise and resubmit work schedule affected by accepted alternates.

1.4 PROPOSED PRODUCTS LIST

Not Applicable

1.5 CONTRACTOR-PREPARED SHOP DRAWINGS

- A. Submit in the form of electronic document AutoCAD or pdf format.
- B. After review, reproduce and distribute copies in accordance with Paragraph on Procedures above and for Record Documents described in Division 01 Section 01 7700, "Project Closeout"
- C. Submit ¼" scale floor plans indicating proposed routing of new piping, electrical and duct systems, new and relocated equipment locations and connection points to existing services including sections through equipment and piping diagrams of all connections.
- D. Identify equipment, pipe risers, duct risers, column lines, etc., with designations shown on Contract Documents.

1.6 PREVENTIVE MAINTENANCE (PM) TASKS/SCHEDULE

- A. Within 10 days after date of Notice to Proceed, submit complete listing of PM tasks.

1.7 PRODUCT DATA

- A. Submit the number of copies as established at the preconstruction conference.
- B. Mark each copy to identify applicable products, models, systems, equipment tags and Mark each copy to identify applicable products, models, systems, equipment tags, and other data. Supplement manufacturer's standard data to provide information unique to this Project.
- C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Division 01 Section 01 7700 "Project Closeout"

1.8 SAMPLES

Not Applicable

1.9 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, instructions for delivery, storage, assembly, installation, start-up, adjusting, testing, in quantities specified for Product Data.
- B. Identify conflicts between manufacturers' instructions and contract documents

1.10 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review in quantities specified for Product Data.

- B. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product but must be acceptable to Engineer.

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

Not Applicable

END OF SECTION

County of Champaign Submittals Brookens Chiller Replacements Section
01 3300 -3

SECTION 01 4000 QUALITY CONTROL SERVICES

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control of installation
- B. References
- C. Manufacturers' field services and reports

1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions and workmanship to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.
- E. Work to be performed by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.3 REFERENCES

- A. Conform to reference standard by date of Owner-Contractor Agreement when there are no Bids date specified in product Sections.
- B. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 MANUFACTURERS' FIELD SERVICES, FIELD TESTS AND REPORTS

- A. When specified in individual specification Sections, Contractor shall require material or Product suppliers, Subcontractors, or manufacturers to provide qualified staff personnel to observe site conditions; testing; conditions of installation; quality of workmanship; start-up of equipment; testing, adjusting and balancing of equipment and materials; and troubleshooting as applicable B and to initiate instructions when necessary. Submit report per paragraph C below, this section.
- B. Report observations and site decisions or instructions given to Owner, applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit written report in duplicate within 10 days of observation, start-up, testing, etc. to Engineer for review.

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

Not Applicable

END OF SECTION

SECTION 01 6000 MATERIAL AND EQUIPMENT

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Products
- B. Transportation and handling
- C. Storage and protection
- D. Product options
- E. Substitutions

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. Provide interchangeable components of the same manufacturer for similar components.

1.3 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

1.4 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.
- B. For exterior storage of fabricated products, place on sloped supports above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement or damage.
- G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications; no options or substitutions allowed.
- C. Product Specified by Naming One Manufacturer as a Base and Naming Others as Acceptable: Obligations listed in paragraphs in 1.7.D. below apply when an "Acceptable Other" is used. Manufacturer named on the drawings and in equipment scheduling are to be considered as a Base; with respect to the particular product described, other manufacturers named in those documents are acceptable others.
- D. When an "Acceptable Other" manufacturer is used in lieu of Specified, Contractor shall coordinate mechanical, plumbing and electrical requirements and will bear any additional costs required by other subcontractors as a result of the proposed product.

1.6 SUBSTITUTIONS

- A. Refer to General Conditions.
- B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that the Bidder:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the Substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Has investigated that the proposed product can be installed in the space available with access for servicing and maintenance.
 - 5. Has coordinated mechanical, plumbing and electrical requirements and will bear any additional costs required by other subcontractors as a result of the proposed product.
 - 6. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 7. Will reimburse Owner for review or redesign services associated with re-approval by authorities.
- 8. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, or when acceptance will require revision to the Contract Documents.
- 9. Substitution Submittal Procedure:
 - i. Submit two copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - ii. Submit shop drawings, product data and certified test results attesting to the proposed product equivalence.
 - iii. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

PART 2 – PRODUCTS

Not Applicable

PART 3 – EXECUTION

Not Applicable

END OF SECTION

SECTION 01 7700 PROJECT CLOSEOUT

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures
- B. Final cleaning
- C. Adjusting
- D. Project record documents
- E. Operation and maintenance data
- F. Warranties
- G. Spare parts and maintenance materials

1.2 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected and that Work is complete in accordance with Contract Documents and ready for inspection by Engineer.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Owner will occupy all portions of the building.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean equipment and fixtures to a sanitary condition.
- C. Replace strainers and replace filters of operating equipment affected by new installation.
- D. Clean debris from roofs, gutters, downspouts, and drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces affected by installation.
- F. Remove waste and surplus materials, rubbish and any construction facilities and equipment from the site.

1.4 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other Modifications to the Contract
 - 5. Reviewed shop drawings, product data, and samples
 - 6. Store Record Documents separate from documents used for construction.
 - 7. Record information concurrent with construction progress.

- B. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 8. Manufacturer's name and product model and number
 - 9. Product substitutions or alternates utilized
 - 10. Changes made by Addenda and Modifications
- C. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 11. Measured depths of foundations in relation to finish [first] [main] floor datum
 - 12. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements
 - 13. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work
 - 14. Field changes of dimension and detail
 - 15. Details not on original Contract Drawings
- D. Submit changes to Record Documents in AutoCAD format and pdf format.
- E. Delete Engineer title block and seal from all documents.
- F. Submit documents to Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

- A. Quality Assurance
 - 1. Instructions and data are to be prepared by personnel experienced in maintenance and operation of described products.
- B. Binders: Commercial quality, 3-D side ring binders with hardback, cleanable, plastic covers. When multiple binders are used, correlate data into related consistent groupings.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project. Include subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below with tab titling clearly printed under reinforced laminated plastic tabs.
- E. Contents: Prepare a printed Table of Contents for each volume, with each Product or System description identified.
- F. Part 1: Directory listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors and major equipment suppliers.
- G. Part 2: Operation and maintenance instructions, arranged by system and subdivided by component. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - 1. Significant design criteria.
 - 2. List of equipment.
 - 3. Parts list for each component.
 - 4. Operating instructions.
 - 5. Maintenance instructions for equipment and systems.
 - 6. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

H. Part 3: Project documents and certificates, including the following:

1. Shop drawings and product data.
2. Air and water balance reports.
3. Certificates.
4. Photocopies of warranties.

I. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection with Engineer comments. Revise content of documents as required prior to final submittal.

J. Submit final volumes revised within ten days after final inspection.

1.7 WARRANTIES

- A. Execute and assemble documents from Subcontractors, suppliers and manufacturers.
- B. Provide Table of Contents and assemble in 3-D side ring binder with durable cover.
- C. Submit prior to final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site and place in location as directed; obtain receipt from Owner prior to final payment.

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

Not Applicable

END OF SECTION

SECTION 20 0500**BASIC REQUIREMENTS FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION****PART 1 -GENERAL****1.1 SECTION INCLUDES**

- A. Basic mechanical requirements specifically applicable to Divisions 20 and 23.

1.2 SCOPE OF WORK

- A. The following description is a general description of the HVAC this project. This work description is not all inclusive but is offered to give the Contractor a general idea of the scope of the project.

1. HVAC work includes but is not limited to the following:
 - a. Installation of two air-cooled scroll chillers
 - b. New chilled water piping and exterior insulation
 - c. Temperature controls modifications for new equipment

1.3 DEFINITIONS

- A. The following words or phrases have special meaning when used in the articles of this Division and in any other requirements applicable to this division:
1. "Exposed to View" or "Exposed" — shall have reference to and mean that the pipes, ducts, etc., insulated or otherwise, in the completed structure are visible within any normally occupied space, room or area.
 2. "In Concealed Spaces", "Concealed" or "Not Exposed to View" — shall have reference to and mean that the pipes, duct, etc., insulated or otherwise are concealed and not exposed to view within furred spaces, above suspended ceilings, pipe chases, etc.
 3. "Unfinished Spaces" or "Unfinished Rooms" — shall have reference to areas such as Machine Rooms, Equipment Rooms, or similar areas. Where the words "In Finished Areas" or "Finished Rooms" are used, it shall have reference to rooms or spaces, such as, Reading rooms, Offices, Public Corridors, etc.
 4. "Finished Rooms or Spaces" shall refer to areas similar to offices, public corridors, and public toilet rooms.
 5. "Provide" — shall be taken to mean "furnish and install" meaning to purchase and deliver to the job site and the installation thereof.
 6. "Piping" — shall include, in addition to pipe all fittings, valves, hangers, and other supports, expansion compensators, anchors, and accessories related to such piping including associated insulation.
 7. "Ductwork" — shall include, in addition to ducts, all fittings, transitions, dampers, hangers and other supports, fire dampers, access panels, associated insulation and accessories related to such ductwork.
 8. "Contractor" in Specifications and Drawing refers to respective Contractor performing that portion of work.
 9. "Invert Elevation" (I.E.) means elevation of inside bottom of pipe or duct.
 10. "Mechanical Work" is work in Divisions 20, 21, 22, and 23.

NOTE0 The words "Contractor shall" are implied and shall be so understood wherever the directions "furnish, "install", or "provide" are used.

1.4 SPECIAL CONDITIONS

- A. Minor items and accessories or devices reasonably inferable as necessary to the complete and proper operation of any system shall be provided by the Contractor for such system whether or not they are specifically called for by the Specifications or Drawings.
- B. Where work specified in other sections of the specifications connects to equipment specified in Divisions 20 and 23 Sections, check the required connection to such equipment.

1.5 WORK BY OWNER

- A. The following work shall be by the Owner: Not applicable

1.6 OWNER-FURNISHED PRODUCTS

- A. The following products shall be furnished by the Owner and installed by the Contractor:
 - 1. Air-cooled scroll chillers

1.7 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

1.8 CONTRACTOR USE OF PREMISES

- A. Refer to Division 01 and General Conditions.
- B. Limit use of site and premises to allow:
 - 1 Owner occupancy.
 - 2 Use of premises by Owner to conduct normal activities.
 - a. Tie-ins to existing systems must be done in manner so as not to interfere with Owner's operations. All shut downs of existing services require a three day notice minimum in writing.
- C. Schedule the Work to accommodate this requirement.
- D. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- E. The Owner will be responsible for the identification and abatement of all hazardous materials and asbestos associated with the project. Although great care will be taken to eliminate any risks, the Contractor must be aware that hazardous materials may exist on site. Therefore, the Contractor shall immediately suspend work and notify the Owner if asbestos or other hazardous material is suspected in the work area of the project.

1.9 PROJECT SCHEDULE

- A. Provide expected ship date of chillers within 1 week of notice of award.
- B. Project shall be of substantial completion including startup no later than _____.

1.10 REFERENCE STANDARDS**A. Quality Assurance**

1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
2. Conform to reference standard by date of issue current on date of Contract Documents date for receiving bids date of Owner-Contractor Agreement when there are no Bid dates specified.
3. Obtain copies of standards when required by Contract Documents.
4. Maintain copy of applicable standard at job site during submittals, planning and progress of the specific work, until Substantial Completion.
5. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
6. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

B. Reference Standards and Specification Abbreviations

1. Refer to Divisions 01, 20, 21, 22, and 23.

1.11 SUBMITTALS

A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and General Requirements.

B. Submittals shall contain outline dimensions, operating and maintenance clearances and sufficient engineering data to indicate compliance with the specifications. Each submittal shall be clearly labeled as indicated in the Conditions of the Contract and General Requirements.

C. Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼" equals 1'-0" scale, and shall be newly prepared by the Contractor and not reproduced from the Architect's drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.

D. Contractor shall obtain Engineer's approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.

E. The Engineer's review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the Owner, irrespective of any approval by the Engineer.

1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Architect, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.
2. Record documents shall be submitted in compliance with the requirements of the Specifications.

1.12 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship to product Work of specified quality.
- B. Comply fully with manufacturer's instructions/ including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.
- E. Work to be performed by persons qualified to produce workmanship of specified quality.
- F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
- G. Manufacturer's Field Services and Reports
 - 1. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of installation, quality or workmanship, start-up of equipment, testing, adjusting and balancing of equipment and troubleshooting as applicable and to initiate instructions when necessary.
 - 2. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.
 - 3. Submit report in duplicate within ten (10) days of observation to Architect for review.

1.13 CONTRACT CLOSEOUT

- A. Final Cleaning
 - 1. Refer to Division 01.
 - 2. Execute final cleaning prior to final inspection.
- B. Adjusting
 - 1. Adjust operating products and equipment to ensure smooth and unhindered operation.
- C. Project Record Documents
 - 1. Refer to Division 01.
 - 2. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - a. Field changes of dimension and detail.
 - b. Details not on original Contract Drawings.
 - 3. Delete Architect's title block and seal from all documents.
 - 4. Submit documents to Architect with claim for final application for payment.

1.14 SPARE PARTS AND MAINTENANCE DATA

- A. Provide products, spare parts, maintenance and materials in quantities specified in individual specification sections.
- B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

1.15 WARRANTIES

- A. Provide notarized copies.
- B. Execute and assemble documents from Subcontractors, suppliers and manufacturers.
- C. Provide table of contents and assemble in 3-D side ring binder with durable cover.
- D. Submit prior to final application for payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.16 REGULATORY REQUIREMENTS

- A. Conform to 2006 International Mechanical Code with Amendments, State of Illinois Plumbing Code with Amendments and NFPA 13, latest editions.
- B. Obtain permits and request inspections from Champaign County Planning and Development.
- C. Conform to all other governing agencies and authorities.

PART 2 - PRODUCTS**2.1 MATERIAL AND EQUIPMENT**

- A. Refer to Division 01.
- B. Products
 - 1. Products: Means new material, machinery, components, equipment, fixtures and systems forming Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of Work. Products may also include existing materials or components required for reuse.
 - 2. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
 - 3. Provide interchangeable components of same manufacturer for similar components.
 - 4. Transportation and Handling
 - 5. Transport and handle products in accordance with manufacturer's instructions.
 - 6. Promptly inspect shipment to assure that products comply with requirements, quantities are correct and products are undamaged.

2.2 STORAGE AND PROTECTION

- A. Refer to Division 01.
- B. Store and protect products in accordance with manufacturer's instructions/ with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

- C. For exterior storage of fabricated products, place on sloped supports above ground.
- D. Provide off-site storage and protection when site does not permit on-site storage or protection.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- F. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

2.3 PRODUCT OPTIONS

- A. Refer to Division 01.
- B. Products Specified by Reference Standards or by Description only: Any product meeting those standards or description.
- C. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications; no options or substitutions allowed.
 - 1. Documents have been prepared utilizing a single manufacturer as the basis of design. Contractor shall be responsible for coordinating any varying requirements (e.g. space requirements, electrical requirement) when utilizing the other acceptable manufacturers.

PART 3 -EXECUTION

3.1 SCOPE

- A. Work included under Divisions 20, 21, 22, and 23 shall include all labor, services, materials, and equipment and performance of all work required for installation of mechanical, plumbing, and fire suppression systems as shown on Drawings and as herein specified in following sections.

3.2 INTERPRETATION OF CONTRACT DOCUMENTS

- A. Should there be discrepancy or a question of intent, refer matter to Engineer for decision before ordering any equipment or materials or before starting any related work.
- B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.
- C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such system whether or not specifically called for by Specifications or Drawings.
- D. Engineer may change location of any equipment 5' and any piping/ ductwork/ conduit/ etc. 10' in any direction without extra charge, provided such changes are made before installation.

- E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Architect.
- F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
 - 1. Where headroom or space conditions appear inadequate, notify Architect or Owner's field representative before proceeding with installation.
 - 2. Duct and pipe rerouting and duct size changes shall be made at no additional cost to the Owner.
- G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.
- H. Where there is evidence that parts of the Work specified in Divisions 20 and 23 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.
- I. After review and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.
- J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the Owner.
- K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the Owner's Insurance Underwriters, shall be made by the Contractor without extra cost to the Owner.
- L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.
- M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the Owner.
- N. The Equipment Shop Drawings will be furnished to the Contractor before roughing-in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

3.3 PROJECT/SITE CONDITIONS

- A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.

- B. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- C. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

3.4 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS

- A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.
 - 1. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the Owner and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the Owner or the Architect.

3.5 ERECTION & WORKMANSHIP

- A. Contractor is to be responsible for all work fitting into place in satisfactory, neat and workmanlike manner in every particular, to approval of Engineer.
- B. Unless explicitly stated to contrary, each Contractor shall furnish and install each item of equipment or material hereinafter specified, complete with all necessary fittings, supports, trim, piping, insulation, etc., as required for complete and operating installation.
- C. Equipment and materials shall be installed according to manufacturer's instruction unless otherwise specifically directed by Contract Documents.
- D. Contractor shall provide all necessary OSHA approved rigging, scaffolding, tools, tackle, labor, etc., necessary for the complete installation of the equipment.
- E. Contractor shall adapt his work to job conditions and make such changes as required and permitted by the Architect such as moving his work to clear beams, joints, light fixtures, etc., adjusting risers, etc. avoiding interferences with windows and openings, etc. raising or lowering his work to permit the passing of ductwork or the work of other trades, etc., all as required or as job conditions dictate, without any additional costs to the Owner.
- F. All appliances and equipment shall be installed and connected with best engineering practices and in accordance with the manufacturer's best instructions and recommendations.
- G. Work done by Contractor at the site in the execution of this Project shall be performed only by skilled mechanics, recognized as such in their respective trades in the direct employ either of the Contractor proper or of affiliate firms which have a longstanding and continuing formal agreement with the Contractor for providing the rendered services on similar work of this type.

3.6 PROTECTION FROM INJURY

- A. All pipes, fixtures, traps, equipment, and other parts of the Work shall be protected against injury by freezing or exposure to the weather during construction while stored or installed in place.

3.7 MECHANICAL AND ELECTRICAL WORK COORDINATION

- A. Refer to Division 01.
- B. Provide coordination for type of mechanical and electrical work required for this project for duration of work.
- C. Submittals
 - 1. Coordinate mechanical and electrical work of Divisions 20, 23, and 26 with work of each other and of other Divisions.
 - 2. Coordinate progress schedules, including dates for submittals and for delivery of products.
 - 3. Coordinate location and verify size of pipes, equipment, fixtures, conduit, ducts, openings, switches, outlets, fire sprinkler heads, fire hose cabinets, etc., in progress of the Work. Architectural Drawings shall take precedence over Mechanical and Electrical Drawings.
 - 4. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.
- D. Coordination of Submittals
 - 1. Review shop drawings, product data, and sample for compliance with Contract Documents and for coordination among work of all sections of Project Manual. Transmit to Architect.
 - 2. Check field dimensions and clearances and relationship to available space and anchors.
 - 3. Check compatibility with equipment and work of other sections, electrical characteristics and operational control requirements.
 - 4. Check motor voltages and control characteristics.
 - 5. Coordinate controls, interlocks, wiring of pneumatic switches and relays.
 - 6. Coordinate wiring and control diagrams.
 - 7. Review effect of any changes on work of other sections.
 - 8. Verify and coordinate maintenance of Record Documents.
- E. Coordination of Substitutions and Modifications
 - 1. Review proposals and requests from subcontractors.
 - 2. Verify compliance with Contract Documents and for compatibility with work and products of other sections.
 - 3. Submit to Architect with recommendation for action.
- F. Observation of Work
 - 1. Observe work for compliance with Contract Documents.
 - 2. Maintain list of observed deficiencies and defects; promptly submit to Architect.
- G. Documentation
 - 1. Observe and maintain a record of tests. Record:
 - a. Specification section number, product, and name of subcontractor
 - b. Name of testing agency and name of inspector
 - c. Name of manufacturer's representative present
 - d. Date, time, and duration of tests
 - e. Type of test, and results
 - f. Retesting required

- 1 Assemble background documentation for dispute and claim settlement by Architect.
 1. Submit copies of documentation to Architect upon request.
- H. Equipment Start-Up
 1. Verify utilities, connections and controls are complete and equipment is in operable condition.
 2. Observe start-up and adjustments; record time and date of start-up and results.
 3. Observe equipment demonstrations to Owner; record times and additional information required for Operation and Maintenance Manuals.
- I. Inspection and Acceptance of Equipment
 1. Prior to inspection, verify that equipment is tested and operational, and clean.
 2. Assist Architect with inspection. Prepare list of items to be completed and corrected.

3.8 CUTTING AND PATCHING

- A. Refer to Division 01.
- B. Submit written request in advance of cutting or alteration which affects:
 1. Structural integrity of any element of Project
 2. Integrity of weather-exposed or moisture-resistant element
 3. Efficiency, maintenance, or safety of any operational element
 4. Visual qualities of sight-exposed elements
 5. Work of Owner or separate contractor
 6. Include in request:
 - a. Effect on work of Owner or separate contractor
 - b. Written permission of affected separate contractor
 - c. All items requested in Division 01
- A. Examination
 1. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
 2. After uncovering existing work, inspect conditions affecting performance of work.
 3. Beginning of cutting or patching means acceptance of existing conditions.
- B. Preparation
 1. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
 2. Provide protection from elements for areas which may be exposed by uncovering work.
 3. Maintain excavations free of water.
- C. Cutting and Patching
 1. Execute cutting, fitting, and patching including excavation and fill to complete work.
 2. Fit products together to integrate with other work.
 3. Uncover work to install ill-timed work.
 4. Remove and replace defective or non-conforming work.
 5. Remove samples of installed work for testing when requested.
 6. Provide openings in work for penetration of mechanical and electrical work.

E. Performance

1. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
2. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
3. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
4. Restore work with new products in accordance with requirements of Contract Documents.
5. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
6. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated fire resistant material to full thickness of the penetrated element.
7. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.9 ACCESS PANELS

1. Where control valves, shut-off valves, drip traps, heating coils, dampers, pull boxes or other specialties, which require service or adjustment, are installed above inaccessible type furred ceilings or within furred walls, Contractor whose equipment is involved shall furnish and install access panels as required.
2. Access panels shall be of sufficient size to make possible servicing, adjustment, removal and replacement of concealed equipment through opening provided. Panels shall be sized as shown on drawings, or if sizes are not shown, shall be minimum of 16" x 24" in walls and 24" x 24" in ceilings.
3. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.
4. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.

3.10 SOUND CONTROL

1. Mechanical penetrations into shall be maintained airtight to prevent sound transfer.
2. Conduits shall be grouted or sealed tightly in place.
3. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.11 FIRE RATED PENETRATIONS

1. Sleeves for pipes and ducts through fire rated and fire resistive floors and walls shall be constructed of materials classified by UL to provide fire stopping equal to time rating of construction being penetrated. Use asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E 814.

- B. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.
- C. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- D. Where floor openings without penetrating items are more than 4" in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- E. Protect materials from damage on surfaces subject to traffic.
- F. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- G. Keep areas of work accessible until inspection by applicable code authorities.
- H. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.
- I. Clean up spills of liquid components.
- J. Neatly cut and trim materials as required.
- K. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.12 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3' access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers. Piping includes, but is not limited to, plumbing, fire suppression, mains (not branch piping with sprinkler heads), hydronic heating or cooling, steam and condensate, and fuel systems.
 - 1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4" high turned up edge. Bottom of drain pan shall slope to a single drainage point at 1/8" per foot. A 1" diameter clear plastic tube shall allow collected fluid to drain to the nearest open site floor drain. Secure plastic tubing to building structure only.
 - 2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.
 - 3. Drain pans shall include liquid detectors with alarms only if noted on the drawings.
- B. Provide sprinkler heads beneath drain pan only as required by NFPA.
- C. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to Owner, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space.

3.13 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.

- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence or other conditions which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with paragraph 1.12 previously specified that equipment or system has been properly installed and is functioning correctly.

3.14 TESTING, ADJUSTING AND BALANCING

- A. Contractor shall appoint, employ and pay for services of independent firm to perform testing, adjusting and balancing.
- B. Independent firm will perform services specified in Division 01 and Division 23 Section 23 0593/ "Testing/ Adjusting/ and Balancing for HVAC."
- C. Reports will be submitted by independent firm to Architect indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.

3.15 REMODELING PROJECT PROCEDURES

- A. Refer to Division 01.
- B. Demolition
 - 1. Contractor shall remove existing equipment and materials pertaining to his contract as specified or as required, whether shown on Drawings or not, to prepare for new work of all contracts.
 - 2. Where necessary, reroute piping, ducts, conduits, wiring, etc. from within walls, floors, ceilings, etc. being removed. Contractor involved with interrupted service shall be responsible for accomplishing required work whether shown on Drawings or not.
 - 3. Cap all abandoned or terminated piping, conduit, etc. below floor, behind wall surface, above ceiling, etc. as required to be completely concealed after new work is complete.
 - 4. In general, mechanical remodeling work is shown on Mechanical Drawings but carefully study all drawings for all contracts for "demolition" and "remodeling" work in existing building and field check to verify locations where such work is being done to determine exact extent of work required. No extra will be allowed for additional work required because of demolition or remodeling whether or not work is specifically noted, itemized or shown on Drawings.
 - 5. Contractor shall cap or plug all pipes, valves, fittings, etc. left open after demolition if they are not to be reused.

3.16 CLEANING, FLUSHING, INSPECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- B. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4' per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.
- C. Inspect pressure piping in accordance with procedures of ASME B31.

3.17 PIPING TESTS

- A. Test pressure piping in accordance with ASME B31.
- B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - 1. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
 - 2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.
- D. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

SECTION 20 0519 METERS AND GAUGES FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION

PART 1 -GENERAL

1.1 SCOPE OF WORK

- A. Meters and gauges specifically applicable to Divisions 20, 21, 22, and 23, including:
 - 1. Thermometers for piping
 - 2. Pressure gauges for piping
 - 3. Test plugs for piping

1.2 CODES AND STANDARDS (USE LATEST EDITION)

- A. American Society of Mechanical Engineers (ASME)
 - 1. ASME B40.100 – Pressure Gauges and Gauge Attachments
 - 2. ASME B40.200 – Thermometers, Direct Reading and Remote Reading
 - 3. ASME B40.3 – Bimetallic Actuated Thermometers

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated provide manufacturer's literature.
- B. Shop Drawings: Schedule for instrumentation indicating manufacturer's number/ scale range, and location for each.
- C. Operations and Maintenance Data: Submit under provisions of Division 01. Accurately record location of all instrumentation.

PART 2 -PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS FOR PIPING

- A. Acceptable Manufacturers
 - 1. Ashcroft Inc.
 - 2. H.O. Trerice Company
 - 3. Miljoco Corporation
 - 4. Weiss Instruments, Inc.
- B. Direct reading liquid-in-glass thermometer complying with ASME B40.200
 - 1. Case: Die-cast aluminum, 7" long
 - 2. Tube: Blue colored spirit (organic) filled, lens front
 - 3. Tube Background: Aluminum white with permanently etched scale calibration in degrees Fahrenheit
 - 4. Window: Clear acrylic or glass; provide glass for steam and condensate applications
 - 5. Connector: Adjustable angle joint with positive locking device
 - 6. Stem: Brass of length to suit installation
 - 7. Accuracy: $\pm 1\%$ scale division
 - 8. Thermowells: Brass, pressure-tight, socket-type fitting made for insertion into piping and of type, diameter, and length required to hold thermometer clear of any pipe insulation.
 - 9. Basis of Design: H.O. Trerice Company Model AX9-2

2.2 PRESSURE GAUGES FOR PIPING

A. Acceptable Manufacturers

1. Ashcroft Inc.
2. H.O. Trerice Co.
3. Miljoco Corporation
4. Weiss Instruments, Inc.
5. Dial type pressure gauge complying with ASME B40.100
6. Case 0 4½" diameter black aluminum
7. Pressure Element Assembly: Bronze bourdon tube
8. Pressure Connection: Brass socket
9. Movement: Rotary stainless steel
10. Dial: Aluminum with permanently etched black scale calibrated in psi on white background
11. Window: Clear glass
12. Accuracy: ±0.5% percent of full scale
13. Basis of Design: H.O. Trerice Company Model 500XB
14. Pressure Gauge Accessories
 - a. Valves
 - b. ¼ NPT brass needle valve for a maximum pressure of 2,000 psig
 - c. Basis of Design: H.O. Trerice Company Series 735
 - d. Impulse Dampeners
 - e. Brass with ¼ NPT connection
 - f. Basis of Design: H.O. Trerice Company Series 870
 - g. Coil Syphons
 - i. Seamless brass, schedule 40, ¼ NPT connections
 - ii. H.O. Trerice Company Series 885

2.3 TEST PLUGS FOR PIPING

A. Acceptable Manufacturers

1. Petersen Products Co.
2. Sisco Manufacturing Company, Inc.
3. H.O. Trerice Company
4. Watts Water Technologies

C. Test Plug (for insulated pipe)

1. ¼" by 3" long brass fitting for receiving ¼" outside diameter pressure or temperature probe
 - a. Core Inserts: Two self-sealing rubber valve cores with a color coded cap strap with gasket
 - (1) Neoprene (maximum 200°F) at 500 psi
 - (2) Nordel (maximum 275°F) at 500 psi
 - b. Minimum Pressure and Temperature Rating: 1,000 psi at 140°F
 - c. Basis of Design: Model 100XL (neoprene core) or Model 110XL (Nordel core) manufactured by Petersen Products Co.

- d. Test Kit: Furnish one test kit containing one 0-100 psig range pressure gauge, two gauge adapters with 1/8" probes/ one 25°F to 125°F low range thermometer, one 0°F to 220°F high range thermometer, and one internally padded and fitted carrying case. Model 1500XL manufactured by Petersen Products Co.

PART 3 -EXECUTION

3.1 APPLICATIONS

A. Pressure Gauges

1. Provide pressure gauges in locations indicated on drawings with a scale range of those shown below such that the range is between 1½ and 2 times two times the operating pressure of the system.

1. 0-15 psi
2. 0-30 psi
3. 0-60 psi
4. 0-100 psi

B. Thermometers

- C. Install liquid-in-glass thermometers in all chilled water, hot water, condenser water, steam and condensate piping applications as applicable

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install gauges and thermometers in locations where they are easily read from normal operating level.

C. Thermometers for Pipes

1. Install direct-mounting thermometers and adjust vertical and tilted positions.
2. Install thermometers in piping systems in thermowells with socket extending to center of pipe or a minimum of 2" into fluid for piping less than 4". Enlarge pipes smaller than 2½" for installation of thermowells.

D. Pressure Gauges for Pipes

1. Install direct-mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.
2. Provide needle valve and impulse dampener for each pressure gauge installed in pipe carrying all fluids except steam.

E. Install test plugs in tees in piping where indicated.

END OF SECTION

SECTION 20 0529 HANGERS AND SUPPORTS FOR MECHANICAL, PLUMBING AND FIRE SUPPRESSION SYSTEMS

PART 1 -GENERAL

1.1 WORK INCLUDED

A. Hangers and supports specifically applicable to Divisions 20, 21, 22, and 23, including:

1. Multiple Pipe Supports
2. Roof Supports
3. Miscellaneous materials

1.2 CODES AND STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME B31.1 -Power Piping
2. ASME B31.5 -Refrigeration Piping
3. ASME B31.9 -Building Services Piping

B. American Society for Testing and Materials (ASTM)

1. ASTM A1011 -Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (*Formerly ASTM A570*)
2. ASTM A123 -Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
3. ASTM A36 -Steel Plates, Shapes and Bars
4. ASTM A653 -Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process
5. ASTM B633 -Specification for Electrodeposited Coatings of Zinc on Iron and Steel
6. ASTM C150 -Portland Cement
7. ASTM C404 -Uniformly Graded Natural Sand
8. ASTM E-814 -Fire Tests of Through-Penetration Fire Stops

C. American Welding Society (AWS)

1. Specifications for Qualification of Welding Procedures and Welders

D. American Water Works Association (AWWA)

E. Building Officials and Code Administrators International (BOCAI)

1. BOCA -National Building Code
2. BOCA -National Mechanical Code

F. International Conference of Building Officials (ICBO)

G. ICBO -Uniform Building Code

H. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS SP 58 -Pipe Hangers and Supports -Materials, Design and Manufacturer
2. MSS SP 69 -Pipe Hangers and Supports -Selection and Application
3. MSS SP 89 -Pipe Hangers and Supports -Fabrication and Installation Practices

I. National Fire Protection Association (NFPA)

J. NFPA 13 -Standard for the Installation of Sprinkler Systems

K. NFPA 14 -Standard for the Installation of Standpipe and Hose Systems

L. NFPA 101 -Code for Safety to Life from Fires in Buildings and Structures

- L. Southern Building Code Congress International (SBCCI)
 - 1. SBCCI -Standard Building Code
- M. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - 2. SMACNA -HVAC Duct Construction Standards, Metal and Flexible
- N. UL
 - 1. UL 1479 -Fire Tests of Through Penetration Firestops and Building Joint Systems
- O. Factory Mutual (FM)

1.3 QUALITY ASSURANCE

- A. Supports for Mechanical and Plumbing Piping: Provide products in compliance with MSS Standards:
 - 1. Provide pipe hangers and supports of which materials, design and manufacture comply with MSS SP-58.
 - 2. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - 3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - 4. Terminology used in this section is defined in MSS SP-90.
- B. Supports for Sprinkler Piping: Provide products which are UL listed and FM approved and in conformance with NFPA 13.
- C. Supports for Standpipes: Provide products which are UL listed and FM approved and in conformance with NFPA 14.
- D. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code -Steel."
- E. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.4 SUBMITTALS

- A. Product Data: Submit product data on all hanger and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.
- B. Shop Drawings: Show fabrication and installation details and include Product Data for components:
 - 1. Metal framing systems
 - 2. Pipe stands

1.5 DELIVERY, STORAGE AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

PART 2 -PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers

1. B-Line Systems, Inc.
2. Fee and Mason Manufacturing Company
3. Anvil International

B. Construction

1. General Service
 - a. Exterior insulated pipe: Carbon steel with hot-dip galvanized finish after fabrication

C. Piping system classification

1. Type C-1 Cold Systems (33°F -59°F)
 - a. Chilled Water

D. Pipe supports shall be provided as indicated the table below.

Pipe Hanger and Support MSS Types									
Class		C-1				C-2			
Pipe Size		≤ 2"		> 2"		≤ 2"		> 2"	
Insulation ⁽¹⁾		Yes	No	Yes	No	Yes	No	Yes	No
Horizontal Pipe Attachments	Steel Clips	26 w/40	24 & 26	26 w/ 40	24 & 26	N/A	N/A	N/A	N/A
	Malleable Iron Rings	N/A	6, 11, & 12	N/A	6, 11, & 12	N/A	N/A	N/A	N/A
	Steel Bands	1 w/ 40	1	1 w/ 40	1	1 w/ 40	1	1 w/ 40	1
	Steel Clamps	3 & 4	3 & 4 w/ 40	3 & 4	3 & 4 w/ 40	N/A	3 & 4	N/A	3 & 4
	Cast Iron Hanging Rolls	N/A	N/A	41 & 43 w/ 40	41 & 43	N/A	N/A	41 & 43 w/ 40	41 & 43
	Cast Iron Supporting Rolls	N/A	N/A	44, 45, & 46 w/ 39	44, 45, & 46	N/A	N/A	44, 45, & 46 w/ 39	44, 45, & 46
	Steel Trapezes	59 w/ 40	N/A	59 w/ 40	N/A	N/A	N/A	N/A	N/A
	Steel Protection Saddles and Shields	40	N/A	40	N/A	40	N/A	40	N/A
	Steel or Cast Iron Stanchions	36, 37, & 38 w/ 40	36, 37, & 38	36, 37, & 38 w/ 40	36, 37, 38	36, 37, & 38 w/ 40	36, 37, 38	36, 37, & 38 w/ 40	36, 37, 38
	Steel Welded Attachments	(2)		(2)		(2)		(2)	

(1) Hangers on insulated systems shall incorporate protection saddles or shields or shall be clamped or welded to the pipe and project through the insulation to provide external attachment.

(2) The design shall be in accordance with MSS SP-58.

Pipe Hanger and Support MSS Types - Part 3						
Class		A-1	B	C-1	C-2	
Vertical Pipe Attachments	Steel Riser Clamps (2 Bolt)	8	8	8	8	
	Steel Riser Clamps (4 Bolt) ⁽¹⁾	42	42	42	42	
Hanger Rod Fixtures	Steel or Malleable Iron	Turn Buckles	13 & 15	13 & 15	13 & 15	
		Swing Eyes	16 & 17	16 & 17	16 & 17	
		Clevises	14	14	14	
Building Structure Attachments	Steel and/or Malleable Iron	Inserts ⁽²⁾	18	18	18	
		C-Clamps ⁽³⁾	19 & 23	19 & 23	19 & 23	
		Beam Clamps ⁽⁴⁾	20, 21, 25, 27, 28, 29, & 30	20, 21, 25, 27, 28, 29, & 30	20, 21, 25, 27, 28, 29, & 30	20, 21, 25, 27, 28, 29, & 30
		Welded Attachments ⁽⁴⁾	22, 57, & 58	22, 57, & 58	22, 57, & 58	22, 57, & 58
		Brackets	31, 32, 33, & 34	31, 32, 33, & 34	31, 32, 33, & 34	31, 32, 33, & 34

- (1) *The design shall be in accordance with MSS SP-58.*
- (2) *Refer to 2.7 – Upper Attachments for approved inserts.*
- (3) *All C-Clamps shall be provided with a retaining strap held securely to the clamp with a hex nut of locking slot. C-Clamps shall not be used with bar joist structure.*
- (4) *Clamps for direct attachment to bar joist structure shall be MSS Type 21 center beam clamp located at the plates along the bottom or top chord of the joist.*

2.2 MULTIPLE PIPE SUPPORT SYSTEMS

A. Acceptable Manufacturers

1. Cooper B-Line
2. Anvil International
3. Unistrut Corporation

B. Multiple Pipe Supports: Pipe supporting elements mounted to cold formed 12 gauge strip steel channel framing with thermoset acrylic finish. Provide specified pipe supporting elements to keep pipe in alignment and allow for expansion. Provide all channel nuts and accessories required to mount pipe supporting elements. Model P1000 by Unistrut.

C. Provide tubing clamps at each pipe support. Provide cushion inserts for uninsulated tubing.

3. Select hanger rods for two times the trapeze loads but not less than 3/8" diameter.
4. Secure hanger rod with square washers and locking nuts on top and bottom of strut.

2.3 ROOF SUPPORTS

- A. Permanent pipe support
 1. Acceptable Manufacturers:
 - a. Pate PRS/MPRS
 2. Factory fabricated 18 gauge galvanized sheet steel support curb with fully welded corner seams, and 18 gauge galvanized steel counterflashing with galvanized steel channel track attached.
 3. Vertical and horizontal adjustable roller assembly of galvanized steel channel track, galvanized steel fittings, washers and nuts and a painted cast iron roller.
 4. Support shall be designed to be compatible with roofing system and roofing pitch.
 5. Fixed Height Roller
 - a. UV resistant rubber base with fixed height electroplated cast iron MSS type 44 pipe roll. Cooper B-Line DBR.
 6. Adjustable Height Channel
 - a. Roof support: UV resistant rubber base with two 1/2" galvanized steel threaded rod risers and one 12 gauge galvanized steel horizontal channel support. Cooper B-Line DBE.
 - b. Pipe support: Electroplated cast iron MSS type 44 pipe roll
 7. Fixed Height Channel
 - a. Roof support: UV resistant rubber base with fixed height 12 gauge galvanized steel horizontal channel support. Cooper B-Line DB6.
 - b. Pipe support: Electroplated cast iron MSS type 44 pipe roll

2.4 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

PART 3 -EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

- A. Hanger and Support Installation
 1. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
 2. Pipe Stand Installation:
 - a. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 3. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
 4. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 5. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 6. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

B. Hanger and Support Spacing

1. Pipe shall be adequately supported by pipe hanger and supports specified in Part 3. Hangers for insulated pipes shall be sized to accommodate insulation thickness.
2. Horizontal steel piping shall be supported in accordance with MSS SP-69 Tables 3, 4, and 5, excerpts of which follow below:

Maximum Horizontal Pipe Hanger and Support Spacing Without MSS Type 40 Shields (feet)									
Nominal Pipe or Tube Size	Standard Weight Steel Pipe		Copper Tube		Fire Protection	Ductile Iron Pipe	Cast Iron Soil	Glass	Plastic
	Water Service	Vapor Service	Water Service	Vapor Service					
1/4	7	8	5	5	Follow requirements of the NFPA.	20 feet maximum spacing; minimum of one hanger per pipe section close to the joint behind the bell and at change of direction and branch connections. For pipe sizes six inches and under subjected to loadings other than weight of pipe and contents, the span shall be limited to the maximum spacing for water service steel pipe.	10 feet maximum spacing; minimum of one hanger per pipe section close to joint on the barrel and at change of direction and branch connections.	8 feet maximum spacing; follow manufacturer's recommendations.	Follow pipe manufacturer's recommendations for material and service condition.
3/8 - 1/2	7	8	5	6					
3/4	7	9	5	7					
1	7	9	6	8					
1-1/4	7	9	7	9					
1-1/2	9	12	8	10					
2	10	13	8	11					
2-1/2	11	14	9	13					
3	12	15	10	14					
4	14	17	12	16					
5	16	19	13	18					
6	17	21	14	20					
8	19	24	16	23					
10	22	26	18	25					
12	23	30	19	28					
14	25	32							
16	27	35							
18	28	37							
20	30	39							
24	32	42							
30	33	44							

Maximum Horizontal Pipe Hanger, Support, and Shield Spacing With MSS Type 40 Shields (ft)			
Standard Weight Steel Pipe			
Nominal Pipe Size	Shield Length (inches)	Shield Thickness (gage)	Hanger and Support Spacing (feet)
1/2 - 1-1/4	12	18	7
1-1/2	12	18	9
2 - 3	12	18	10
4	12	16	10
5 - 6	18	16	10
8 - 14	24	14	10
16 - 24	24	12	10
Copper Tubing			
Nominal Pipe Size	Shield Length (inches)	Shield Thickness (gage)	Hanger and Support Spacing (feet)
1/4 - 3/4	12	18	5
1	12	18	6
1-1/4	12	18	7
1-1/2 - 2	12	18	8
2-1/2	12	18	9
3	12	18	10
4	12	16	10
5 - 6	18	16	10
8	24	14	10

3.2 ROOF SUPPORTS

- A. Verify that roofing system is complete and roof surfaces are smooth, flat, and ready to receive work of this section.
- B. Clean surfaces of roof in areas to received supports.
- C. Install in accordance with manufacturer's instructions.
- D. Pipe and Duct Supports
 - 1. Locate bases and support framing as indicated on drawings and as specified herein. Provide complete and adequate support of all piping and ducts whether or not all required devices are shown.
 - 2. The use of wood for supporting piping is not permitted.
 - 3. Provide supports spaced so deflection of piping does not exceed L/240 of span.
 - 4. Install framing at spacing indicated, but in no case at greater than 10 feet (3 m) on center.

3.3 METAL FABRICATIONS

- A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

B. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1½”.

C. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

3.5 PAINTING

Not Applicable

END OF SECTION

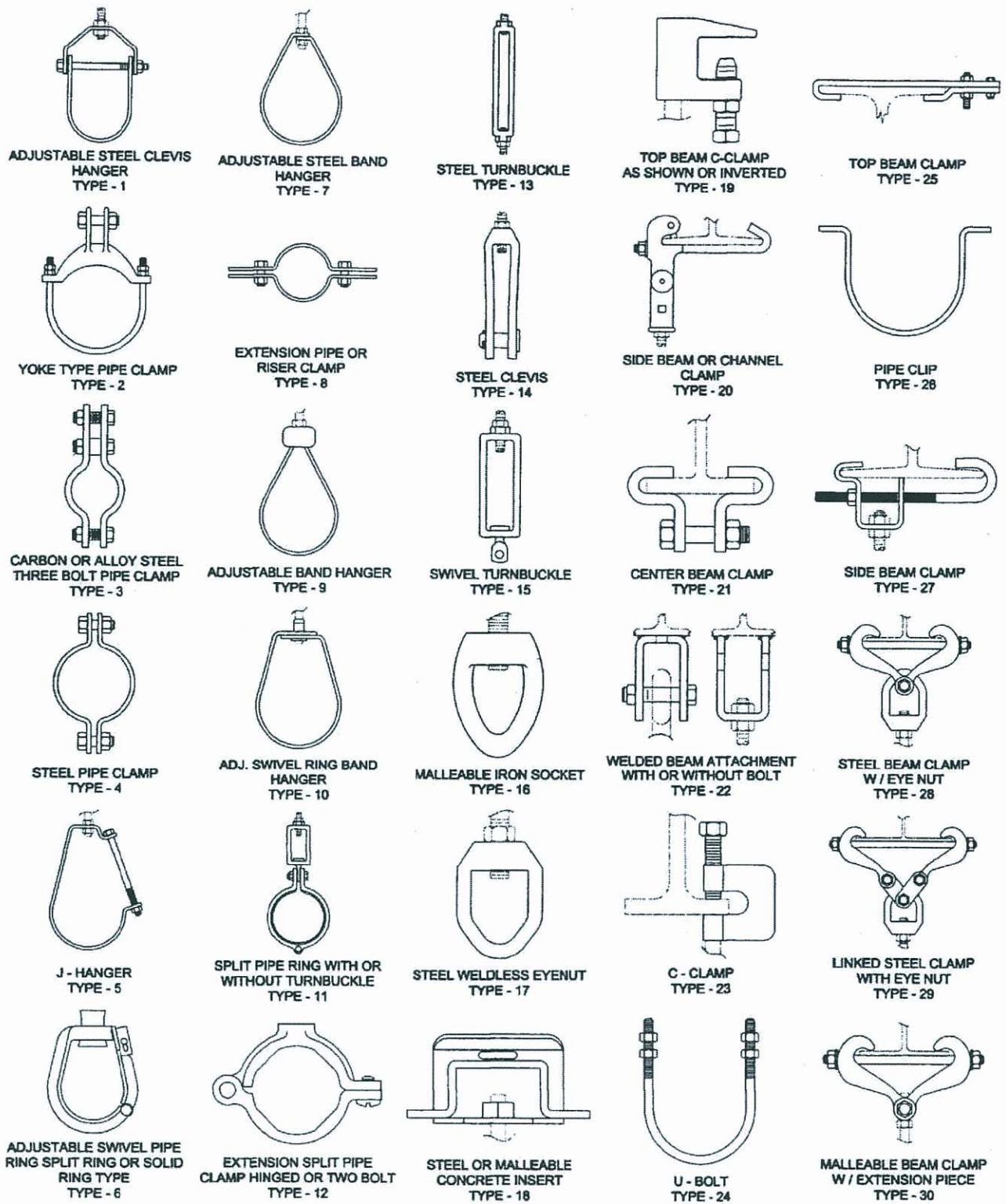


FIGURE 1. TYPE CHART

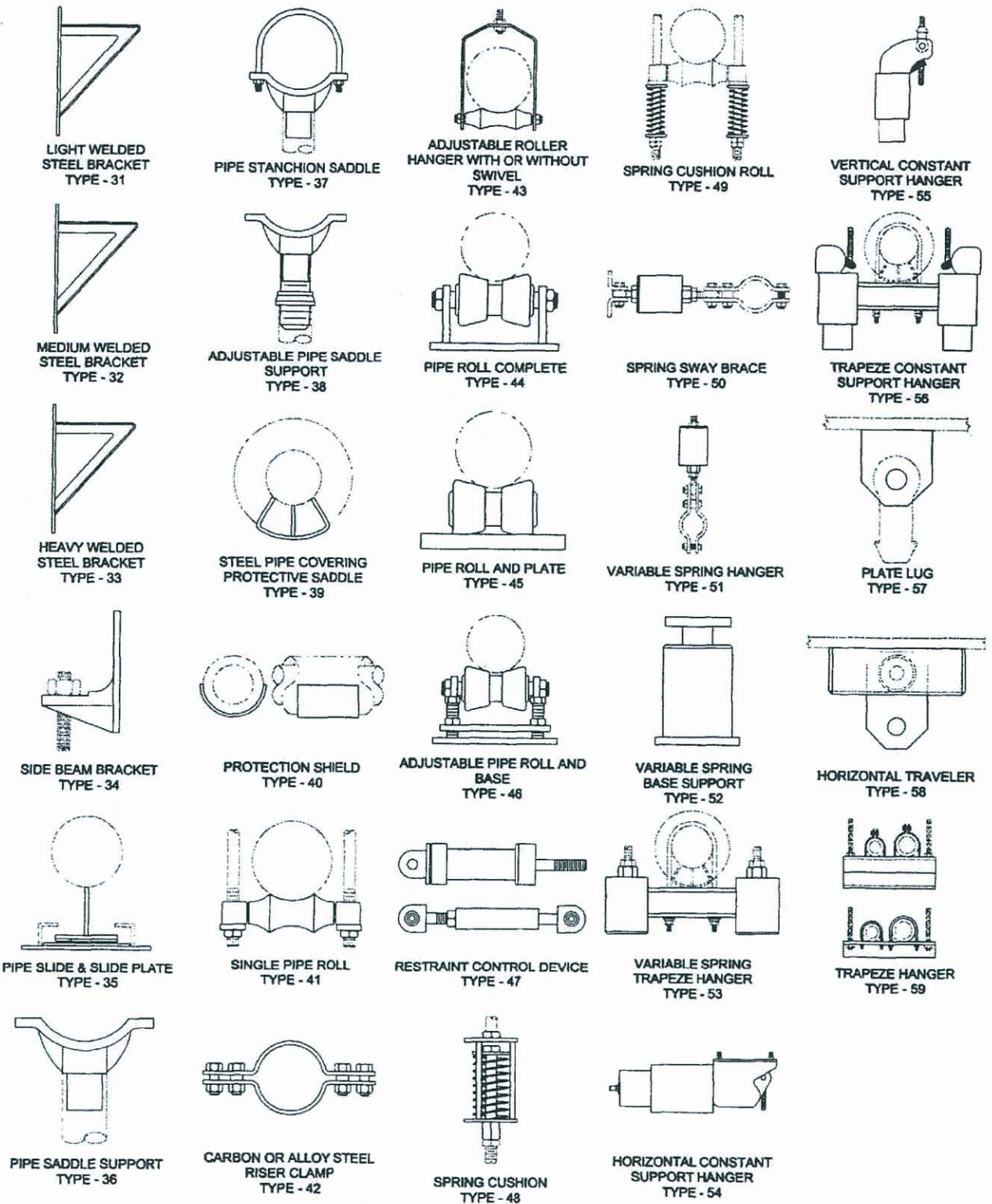


FIGURE 1. TYPE CHART

SECTION 20 0700 THERMAL INSULATION FOR MECHANICAL, PLUMBING, AND FIRE SUPPRESSION

PART 1 -GENERAL

1.1 SCOPE OF WORK

A. Thermal insulation products specifically applicable to Divisions 20 and 23, including:

1. Insulation
2. Protective coverings
3. Accessories
4. Repairs to all existing insulation cut or damaged by work performed under this Contract.
 - a. Products furnished but not installed under this section: None.
 - b. Products installed but not furnished under this section: None.
 - c. Services provided:
5. Design -None.
6. Training -None.
7. Obtain permits -None.

1.2 DEFINITIONS

1. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.
2. Ductwork Insulation: Thermal insulation applied to prevent heat transmission to or from a duct system.
3. Equipment Insulation: Thermal insulation applied to prevent heat transmission to or from a piece of equipment that is part of a plumbing, heating or cooling system.
4. Jacket: Protective covering over insulation; $\mu\pi\gamma\ \upsilon\iota\ \iota\upsilon\eta\omega\pi\eta\gamma\ \gamma\eta\lambda\omega\tau\iota\varsigma\ \alpha\phi\eta\tau\ \gamma\alpha\epsilon$ 'all service jacket" or field applied to provide additional protection; of such materials as canvas, polyvinyl chloride (PVC), aluminum or stainless steel.
5. Vapor Retarder Jacket: Insulation jacket material which impedes the transmission of water vapor.
6. Insert: Spacer placed between the equipment support system and the equipment to allow for the space required for insulation.
7. Insulation Shield: Buffer material placed between the equipment support system and the insulation to prevent the insulation material from crushing.

1.3 CODES AND STANDARDS

- A. American Society for Testing and Materials (ASTM)
1. ASTM A167 -Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 2. ASTM B209 -Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M -Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate).

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3. ASTM C177 -Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
4. ASTM C195 -Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449/C449M -Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C518 -Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
7. ASTM C534 -Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C547 -Standard Specification for Mineral Fiber Preformed Pipe Insulation.
9. ASTM C449 -Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
10. ASTM C553 -Mineral Fiber Blanket and Felt Insulation (Industrial Type).
11. ASTM C612 -Mineral Fiber Block and Board Thermal Insulation.
12. ASTM C795 -Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
13. ASTM C921 -Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
14. ASTM D1784 -Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
15. ASTM E84 -Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E96 -Standard Test Methods for Water Vapor Transmission of Materials.
17. Midwest Insulation Contractors Association (MICA) -Commercial and Industrial Insulation Standards.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

1. ASHRAE Standard 90.1-1989 Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings.

C. National Fire Protection Association (NFPA)

1. NFPA 255 -Standard Method of Test of Surface Burning Characteristics of Building Materials.
2. NFPA-90A -Installation of Air Conditioning and Ventilation Systems.
3. NFPA-90B -Warm Air Heating and Air-Conditioning Systems.

D. National Insulation and Abatement Contractors Association (NIACA) -Guide to Insulation Product Specifications.

E. North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

F. Underwriters Laboratory (UL)

1. UL 723 -Standard for Test for Surface Burning Characteristics of Building Materials.

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1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years documented experience.
- C. Products: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84 or NFPA 255 or UL 723.
- D. No insulation product shall support or promote mold or fungus growth.

1.5 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Provide a schedule, listing each type of insulation, thickness, density, type of protective covering, etc., and the work and service to which each type of insulation is to be applied. The schedule shall be submitted in quantities consistent with that required in the Conditions of the Contract. No insulation shall be purchased or installed until the schedule is reviewed by the Engineer.
- C. Manufacturer's Installation Instructions: Indicate specific installation instructions per the manufacturers of the various products and indicate how the system (combination of products) will be assembled. Highlight critical environmental factors such as drying time, etc., as well as any variations between the manufacturer's installation instructions and the specified installation instructions along with a reason for the difference.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Deliver products to site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.
- C. Protect products against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged or wet insulation; remove from project site. Damage to products prior to final acceptance of the Work shall be repaired or replaced at no additional cost to Owner.
- D. Where existing insulation has been removed or disturbed, due to new connections and/or alterations, repair and replace existing insulation using materials that match existing, except where existing insulation includes asbestos material.
- E. Existing insulation containing asbestos materials (or thought to contain asbestos materials) must be removed by Owner, either totally or in part, in strict accordance with OSHA Regulations utilizing OSHA approved Contractors. Repair and/or replacement of existing insulation containing asbestos shall be with new products as specified herein.
- F. Maintain ambient conditions required by the manufacturer of each product.

1.7 SPARE PARTS

- A. Six rolls of tape to be used for sealing penetrations in vapor retarder jackets.

1.8 WARRANTY

- A. One year warranty on products and complete installation commencing at the time of Substantial Completion.

1.9 MAINTENANCE

Not Applicable

PART 2 -PRODUCTS

2.1 INSULATION

- A. Acceptable Manufacturers
1. Johns Manville
 2. Owens-Corning
 3. Knauf
 4. Armstrong
 5. Certainteed Corp.
 6. Rock Wool Manufacturing
- B. Type GFP: *Glass fiber pipe* insulation; ANSI/ASTM C547, rigid molded, for use to 850°F; thermal conductivity ('k' value) of 0.23 (Btu)/(hr ft² °F) at 75°F mean temperature, k=0.29 at 200°F, k=0.43 at 400°F; noncombustible factory-applied white kraft paper bonded to aluminum foil and reinforced with glass fibers (ASJ) (vapor permeability shall not exceed .02 perms) that has a self-sealing longitudinal lap which provides positive closure without the use of tools, staples, adhesives, ties or tape at ambient temperatures between 25°F and 110°F shall be provided as a vapor retarder.
- C. Type GFFB: *Glass fiber flexible blanket* insulation; ASTM C553; for use to 250°F; 'k' value of .28 at 75°F mean temperature; commercial grade; ¾ lb/cu ft minimum density; noncombustible factory-applied foil-scrim kraft (FSK) jacket (vapor permeability shall not exceed .02 perms).
- D. Type GFRB: *Glass fiber rigid board* insulation; ASTM C612; for use to 250°F, 'k' value of 0.28 at 75°F mean temperature Class 2; 3 lb/cu ft minimum density; noncombustible factory-applied foil-scrim kraft (FSK) jacket (vapor permeability shall not exceed .02 perms).
- E. Type MFP: *Mineral fiber pipe* insulation; ASTM C-612-83/ASTM E-136, Federal HH-1-558B; rigid molded; 10 lb/cu ft minimum density, surface temperature not to exceed 105°F; foil scrim kraft jacket (FSK). OR all service jacket (ASJ).
- F. Type MFFB: *Mineral fiber flexible blanket* insulation; ASTM C-553/ASTM E-136, Federal HH-1-558B; 6 lb/cu ft minimum density, R-value/inch of 4.2, surface temperature not to exceed 105°F; foil scrim kraft jacket (FSK). OR all service jacket (ASJ).
- G. Type MFRB: *Mineral fiber rigid board* insulation; ASTM C-612-83/ASTM E-136, Federal HH-1-558B, 6 lb/cu ft minimum density, surface temperature not to exceed 105°F; foil scrim kraft jacket (FSK). OR all service jacket (ASJ).
- H. Type FEP: *Flexible elastomeric plastic* insulation; ANSI/ASTM C534; 'k' value of 0.27 at 75°F mean temperature.

2.2 PIPE PROTECTIVE COVERINGS

- A. Acceptable Manufacturers
1. Childers (metal)
 2. Knauf (metal)
 3. Schuller International, Inc. (PVC)
 4. Proto (PVC)

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- B. Interior Applications
 - 1. Vapor Retarder Jackets: Integral to glass fiber insulation as specified above.
 - 2. PVC Jackets: One piece pre-molded high impact PVC fitting covers with fiberglass inserts and accessories, to include elbows, tee/valves, end caps, mechanical line couplings, specialty fittings, jacketing, tacks and PVC tape.
 - 3. Glass Fabric and Mastic: Two coats mastic required with 10 x 10 glass fabric.
- C. Exterior Applications
 - 1. Aluminum Jackets: ASTM B209; 0.016" thick; stucco embossed
 - 2. Stainless Steel Jackets: Type 304 stainless steel; 0.010" thick; smooth finish
 - 3. Glass Fabric and Mastic: Two coats mastic required with 10 x 10 glass fabric.

2.3 PIPE ACCESSORIES

- A. Acceptable Manufacturers
 - 1. Foster
 - 2. Minnesota Mining
 - 3. Chicago Mastic
- B. Insulating Cement: ANSI/ASTM C195; hydraulic setting mineral wool; compatible with the insulation and protective coverings.
- C. Finishing Cement: ASTM C449; compatible with the insulation/fitting covers/jackets.
- D. Adhesives and Tapes: Compatible with insulation and protective coverings.
- E. Metal Jacket bands: ½" wide; 0.016" thick aluminum

PART 3 -EXECUTION

3.1 EXAMINATION

- A. Install products only after piping, ductwork and equipment have been tested and approved.
- B. Verify that surfaces are clean and dry with any and all foreign material removed.
- C. Provide drop cloths or other means of protecting all equipment from drops, spattering, etc. which may be caused by the application of insulating products.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's and NAIMA instructions.
- B. Whenever insulated pipes or ducts pass through sleeves or openings, the full specified thickness of the insulation shall pass through the sleeve or opening, except for sleeves located in fire rated partitions or floors. Space between pipe and sleeve located in fire rated partition or floor shall be sealed.
- C. Contractor shall note that all adhesives shall be applied as specified, in continuous bands for complete coverage. The "spot" application of adhesives is not permitted.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Contractor shall coordinate with support and firestopping requirements as noted elsewhere in the Contract Documents.

3.3 APPLICATION (PIPING)

A. Schedule

INSULATION OPERATING
TYPE TEMP (°F)
Chilled Water and/or Glycol GFP

B. Insulation thickness shall be as follows:

Fluid Design Operating Temperature Range, F	Nominal Pipe Diameter (in.)				
	< 1"	1" to < 1½"	1½" to < 4"	4" to < 8"	8" & up
Above 350°	4.5	5.0	5.0	5.0	5.0
251°-350°	3.0	4.0	4.5	4.5	4.5
201°-250°	2.5	2.5	2.5	3.0	3.0
100°-200°	1.5	1.5	2.0	2.0	2.0
40°-60°	1.5	1.5	1.5	1.5	1.5
Up to 39°	1.5	1.5	2.0	2.0	2.0

1. Use maximum fluid temperature for those systems where fluid temperature is above ambient temperature, minimum fluid temperature for those systems where fluid temperature is below ambient temperature.
2. EXCEPTION: Insulation thickness shall be as follows:

C. Indoor, Exposed Pipe

1. For pipe exposed in mechanical equipment rooms or in finished spaces, insulate pipe, fittings, joints, and valves the same as for concealed applications.
2. Locate insulation and cover seams in least visible locations on exposed piping systems.

D. Where multiple layers of pipe insulation are required, all longitudinal and circumferential joints shall be staggered.

E. Exterior Pipe

1. Insulate the same as for "Indoor, Concealed Pipe"
2. Cover pipe and fittings with aluminum jacket with seams located at 2 o'clock side of horizontal piping. Overlap jacket 90 degrees. Overlap jacket ends (do not butt together) along the length of the pipe (at least 3") and secure jacket with aluminum bands.

F. Insulate all horizontal storm water piping as well as all vertical piping between roof drain body and the first length of vertical piping to first 90 degree elbow down. Insulate roof drain body and seal to roof slab.

G. Omit insulation on chrome-plated exposed piping (except for physically challenged fixtures).

3.4 APPLICATION (EQUIPMENT)

A. Insulation shall be omitted at all equipment name plates and/or data plates.

B. Do not insulate factory insulated equipment.

C. Apply insulation as close as possible to equipment by grooving, scoring and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

- D. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- E. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
- F. Insulate cold tanks and cold heat exchangers, with 1-1/2" thick insulation (Type FEP)
 - 1. Apply a coat of Foster No. 82-31 adhesive to all surfaces to be covered and all surfaces and edges of the insulation. Press edges into place and then press or roll rest of insulation into place. Finish by sealing all joints with appropriate insulating cement.
 - 2. After insulation has been installed, apply two coats of white vinyl lacquer finish.
 - 3. Plate heat exchangers: only insulate fixed end plates and exterior side of splash guards. Do not insulate interior side of splash guards.
 - 4. Insulate the following:
 - a. Chemical Pot Feeders

3.5 ADJUSTING

Not Applicable

3.6 CLEANING

- A. All empty cartons, containers, etc. which have contained insulating materials shall be removed from the site and premises by the Contractor as soon as possible after their contents have been removed.

END OF SECTION

County of Champaign Thermal Insulation Brookens Chiller Replacements Section 20 0700 -7

SECTION 23 0100 COMMON WORK REQUIREMENTS FOR MECHANICAL

PART 1 -GENERAL

1.1 SECTION INCLUDES

A. Basic requirements applicable to all Division 23 work.

1.2 RELATED SECTIONS

A. All specification sections in Division 20 are applicable to Division 23. It is the responsibility of the Division 23 Contractor to obtain all Division 20 specifications and conform to all applicable requirements. Division 20 Sections included are:

1. Section 20 0500: Basic Requirements for Mechanical, Plumbing, and Fire Suppression
2. Section 20 0501: Minor Mechanical, Plumbing, and Fire Suppression Demolition
3. Section 20 0513: Motor Requirements for Mechanical, Plumbing, and Fire Suppression Equipment
4. Section 20 0519: Meters And Gauges for Mechanical, Plumbing, and Fire Suppression
5. Section 20 0700: Thermal Insulation for Mechanical, Plumbing, and Fire Suppression
6. Section 20 2923: Variable Frequency Drives for Mechanical, Plumbing, and Fire Suppression

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

3.1 SCOPE

A. Work included under Divisions 20 and 23 shall include all labor, services, materials, and equipment and performance of all work required for installation of plumbing systems as shown on Drawings and as specified.

END OF SECTION

SECTION 23 0900 BASIC TEMPERATURE CONTROL REQUIREMENTS

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Scope
- B. Quality Assurance
- C. Specifications
- D. Project/Site Conditions
- E. Work by Subcontractors
- F. Coordinated Work
- G. Project Phasing
- H. Hazardous Materials
- I. Design Submittals
- J. Start-up and Testing
- K. Guarantee
- L. Substantial Completion Submittals
- M. Closeout Submittals
- N. Record Documents
- O. Operating and Maintenance (O&M) Manuals
- P. Training
- Q. Preventive Maintenance Contract

1.2 SCOPE

- A. The purpose of this project is to provide new chillers and a new DDC controller for them
- B. The work includes control for the following systems:
 - a. Base Bid 1 – DDC controller for new chillers
- C. Contractor must take special precautions at all times to prevent any damage to Owner's equipment or premises. This Contractor shall be liable for any damage.

1.3 QUALITY ASSURANCE

- A. The system shall be designed, installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have in-place a support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable. Contractor must be an authorized representative of the controller manufacturer and shall be fully backed by same.

- B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be the manufacturer=s latest standard design that complies with the specification requirements.
- C. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, and Governing Radio Frequency Electromagnetic Interference and be so labeled.
- D. This system shall have a documented history of compatibility by design for a minimum of 10 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing controllers and field panels and extend new controllers and field panels on a previously installed network.
- E. The Contractor shall employ specialists in the field of Building Automation Systems including: Programming, Engineering, Field Supervision and Installation. Specialists shall have a minimum of 5 years of experience with Building Automation Systems.
- F. The Contractor shall be responsible for all work fitting into place in a satisfactory, neat, workmanlike manner acceptable to the Owner and Engineer.

1.4 SPECIFICATIONS

- A. The Contract Documents are to be considered scope in coverage only and do not necessarily show the exact location and details of the work to be installed. It shall be the responsibility of the Contractor to furnish and install the work in conformity with the requirements of these Specifications, the applicable codes, regulations and standards, the best trade practices and to meet with the approval of Owner. If any departures from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted immediately to Engineer for approval.
- B. If the drawings and/or specifications are in conflict with governing codes, the Contractor shall submit proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, this specification shall govern.
- C. If the drawings and specifications are in conflict with each other, the more stringent shall apply.

1.5 PROJECT/SITE CONDITIONS

- A. Before submitting Proposal, the Contractor shall visit and carefully examine the individual sites so as to familiarize himself with existing conditions, the amount of work required, the working hours and special auxiliary restrictions of the project requirements including storage and delivery of materials.
- B. The Contractor shall verify all conditions on the job which may affect the installation of the work, and shall familiarize himself with applicable local and state regulations. Any discrepancies or interferences shall be reported immediately to Engineer. Additions to the contract price will not be allowed when they are due to the failure of the Contractor to carefully inspect existing condition.
- C. The submission of a Proposal will be construed as evidence that such examination has been made. Later claims for labor, equipment or material required for difficulties encountered, which could have been foreseen had such examination and evaluation have been, will not be recognized.

1.6 WORK BY SUBCONTRACTORS

- A. The temperature controls contractor for the site is Alpha Controls. Contact Jason Vogelbaugh at 217 299.1379 or JasonV@AlphaACS.com
- B. All Subcontractors to the Contractor shall be approved by Owner.
- C. The Contractor shall be totally responsible for his work and all work by his Subcontractors.

1.7 COORDINATED WORK

- A. This Contractor shall cooperate with other contractors performing work on this project, or other projects at the site, as necessary to achieve a complete, neatly fitting installation for each condition. To that end, each Contractor shall consult the drawings and specifications, for all trades to determine nature and extent of other work.

1.8 PROJECT PHASING

Not Applicable

1.9 HAZARDOUS MATERIALS

- A. If hazardous materials including, but not limited to, asbestos, pollutants, or PCB are in any way suspected, inform Owner immediately and suspend work on that portion of the project.

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION**3.1 DESIGN SUBMITTALS**

- A. Submit all design submittals per Division 01.
 - 1. Submit electronic copies of all drawings and product data every time a submission is made until final approval.
 - 2. Separate submittals may be made: hardware and software.
- B. Engineer shall review and comment on copies submitted.
- C. If design does not conform to the design intent, Contractor shall resubmit to Engineer.
- D. Submittals and drawings shall be sufficient to:
 - 1. Show that the intent of the specification has been met.
 - 2. Provide a document for use by Owner showing all equipment incorporated into the system including both new and existing.
 - 3. Provide a document for use by Owner showing all equipment pneumatic and wiring connections of the system for both new and existing equipment.
- E. Items to be included in hardware drawings at minimum are:
 - 1. Include a complete bill of material of equipment used indicating quantity, manufacturer and model number and other relevant technical data.
 - 2. Include manufacturer's description and technical data/ such as performance curves, product specification sheets and installation/maintenance instructions for the items listed in Division 23 Section 23 0901/ Temperature Control Hardware
 - 3. Provide each electrically operated device with completely coded interconnection wiring diagrams. Show all termination and wiring numbers.
 - 4. Provide schematic wiring diagrams for each control panel. Show all terminations and wiring numbers.

5. Provide schematic wiring diagrams for all field sensors and controllers.
 6. Provide each pneumatic operated device with complete piping diagram.
 7. All schematic diagrams shall show both new and existing equipment for a complete control system schematic.
 8. Provide system schematic diagrams for chiller plant and all other miscellaneous points. Schematics to indicate every monitored/controlled point associated with that system.
 9. Provide system riser diagrams showing all controllers, workstations, network wiring, etc.
- F. Items to be included in software drawings at minimum are:
1. DDC and ASC Controllers
 - a. Provide one manufacturer's program manual to Engineer. Manual shall contain complete description of all factory programs furnished and applications programming language.
 - b. At Engineer's request/ provide programming flow diagrams of the applications software.
 - c. Include a complete description of the operation of the temperature control/monitoring system, including sequences of operation.
 1. Such descriptions are to be in Contractor's own words and not identically repeated from the Drawings.
 2. Where sequences indicate, imply or suggest the use of look up tables based on testing to be performed during the project, Contractor shall include such tables using best guess values as place-holders. Contractor shall use actual measured values as they become available.
 - d. Provide identification of those portions of the control sequences which are defined and activated by the Operator Workstation.
 - e. Provide the control loop algorithms/calculations proposed.
 - f. Provide a controller point list, including both inputs and outputs (I/O), indicating I/O point number, the controlled device associated with the I/O point and the location of the I/O device.
 - g. Provide schedules, lists or other documentation of all operation parameters.
 - h. The Contractor shall provide eight (8) hours of labor at Engineer's office for the principal program writer to meet with Engineer to interpret/review line by line programming.
- G. Quantities of items submitted will not be reviewed by Engineer and are the responsibility of the Contractor.

H. When manufacturer's cut sheets apply to a product series rather than a specific product/ the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Clearly note exact models, options and accessories being provided. General catalogs will not be accepted as cut sheets to fulfill submittal requirements.

I. Drawings and product data not bearing the approval stamp of the Contractor, showing Contractor has reviewed and approved, or containing deviations from the contract documents, will be returned to the Contractor for resubmittal for compliance with above requirements.

J. Equipment furnished and installed which is not reviewed by Engineer and not conforming to the design concept of the project will have to be removed and replaced with acceptable equipment all at the cost of the Contractor.

K. Corrections or changes indicated on drawings and product data shall not be considered as extra work order.

L. Engineers checking and reviewing of drawings is a gratuitous assistance and in no way relieves the Contractor from responsibility for errors or omissions which may exist on the drawings. Whenever such error or omissions are discovered, they must be made good by the Contractor, without any additional cost to Owner, irrespective of any review by Engineer.

M. Provide to Engineer any additional information or data which they deem necessary to determine compliance with these specifications or which they deem valuable in documenting the equipment to be installed.

3.2 START-UP AND TESTING

A. Where new digital controls are being installed they shall be installed to the greatest extent possible before switch over from the existing temperature control system.

1. Prior to switch over, the controllers shall be completely installed, checked and tested.
2. Controller software and hardware shall be verified prior to switch over.

B. Prior to testing and verifying proper system operation, Contractor shall furnish Engineer, for acceptance, electronic copies of the start-up/testing procedure proposed. Engineer must approve the check-out procedure prior to start-up/testing.

C. The start-up/testing procedure shall be submitted in writing one (1) calendar month prior to the projected start of start-up/testing.

D. Check out procedure must include provisions for technicians to specifically check off procedures or tests performed.

E. At minimum, the following shall be included in the checkout procedure:

1. The Contractor shall test and verify proper operation for each control loop.
2. Each control loop check will verify that the controller, manual override, fail-safe control and electric interlocks are operating as intended to accomplish the control strategy.

a. Provide to Engineer trend logs of a minimum of thirty minutes in length, sampling no less frequently than every one minute, registering analog values of controlled variables showing that control loops respond adequately during system start-up as well as steady state conditions.

- a. Logs must show the loop response to a step input of at least 5F change in setpoint or 10% relative humidity change in setpoint.
 2. Contractor shall test and verify that correct terminations/designations of I/O are in place for each input and output.
 3. Contractor shall test and verify that sensors are properly calibrated, operational, and are within the performance parameters established in this specification.
 - a. Contractor shall have onsite instrumentation to calibrate/verify all analog input sensing. Instruments shall themselves be properly calibrated and be of greater accuracy than the sensors installed.
 4. Contractor shall test and verify onsite that operator interface menus and help screens are properly displayed, and that point names and designations are correct.
 5. Contractor shall test and verify communications between controllers.
- E. Start-up of an individual digital controller shall be planned such that the entire switch-over and checkout of a system can occur in less than one day. Incomplete or unverified controller systems shall not be left in operation overnight without permission of Owner.
1. Contractor will not be allowed to switch over additional systems until the present controller being worked on is 100% complete.
- F. After the procedure is approved and after portions of the system are complete (phasing of system installation/commissioning to be approved by Owner) and ready to be placed into regular service, Contractor shall inform Owner of this fact in writing.
- G. Contractor shall agree on start-up dates with Owner.
- H. On each start-up date for completed portions of the system, Contractor shall have on-site qualified vendor field technicians to place the system in operation, making such tests, adjustments and changes as may be found necessary to insure successful operation of the installed equipment and systems.
- I. Contractor shall notify Owner 24 hours in advance when equipment needs to be shutdown during start-up/testing.
- J. All tests shall be documented by the Contractor and certified, verifying that the tests have been performed and that all deficiencies have been corrected.
6. Contractor shall demonstrate on site to Engineer that each input and output operates as specified, control loops are tuned, alarms report as specified, failsafe modes are as specified, and other verification as requested by Engineer and/or Owner to demonstrate that the system has been checked by the Contractor.
 7. All testing must be performed and all deficiencies corrected to Owner's satisfaction.
- K. At the end of start-up/testing, if equipment and systems are operating in a manner satisfactory to Engineer and Owner, Owner will sign a certificate affirming that the systems operation has been tested and accepted in accordance with the terms of his specification. The date of Owner's final acceptance of the entire system (not phased portions) will be the start of the guarantee period.

3.3 GUARANTEE

- A. Workmanship and material for work specified shall be guaranteed free from defects for a period of twelve (12) months after final completion and acceptance by Owner of the entire system, not portions of the system. Note that warranties for individual controllers placed in service will not commence until the entire system is complete and accepted by Owner. Any equipment herein described that is shown to be defective during the guarantee period shall be adjusted, repaired, or replaced at no charge to Owner.

- B. After the final inspection and demonstration, a punchlist of incomplete or unsatisfactory items will be developed by Engineer.
- C. The Contractor shall respond to the punchlist with a date by which all items will be completed/corrected.
- D. Upon completion of all punchlist items, the Contractor shall inform Engineer in writing of this fact. This date will serve as the tentative guarantee start date.
- E. Upon verification that all punchlist items are complete by the Engineer, the tentative guarantee start date will become the actual guarantee start date.
- F. Items which unreasonably delay the start of the guarantee and are beyond the Contractor's control such as change orders late in the project will not be considered in establishing the guarantee start date.
- G. During the guarantee period, software updates/controller improvements (i.e., microprocessor chip changes) shall be provided to Owner at no charge. Coordinate with Owner prior to the installation of such changes.

Note: The intent of G. is to insure that Owner receives any product updates which are directed toward correcting a product problem which may or may not be apparent. It is not intended to automatically extend to Owner new product features or enhancements which did not exist at the time of Contract Award.
- H. At Owner's request/ the Contractor shall visit the building to clarify for the operating personnel any questions as to the proper operation and maintenance of the system during the first year after final acceptance of system.

3.4 CLOSEOUT SUBMITTALS

- A. Contractor shall provide closeout submittals required by the Contract Documents including, but not limited to, the following prior to requesting Final Acceptance of the Work:
 - 1. Record Documents as described in Paragraph 3.5 herein;
 - 2. Operating and Maintenance Manuals for items so required by the various Specification Sections and other items as so requested by Owner and as described in Paragraph 3.6 herein;
 - 3. Warranties, guarantees, and bonds as outlined in Paragraph 3.3 of this section;
 - 4. Keys and keying schedule;
 - 5. Tools, spare parts, maintenance stock of materials, etc.;
 - 6. Evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
 - a. Certificates of Inspection;
 - 7. Certificates of Insurance for products and completed operations;
 - 8. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays;
 - 9. Verification that all training has been reviewed with Owner personnel as described in Paragraph 3.7 herein;
 - 10. Certified copy of final punchlist of itemized work to be completed or corrected (including equipment requiring final connection), stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by Owner;
 - 11. Revised evidence of final, continuing insurance coverage complying with the insurance requirements;
 - 12. Final Application for Payment in accordance with the provisions of the Contract Documents;

- B. Contractor and all Subcontractors and major material suppliers who have furnished material or labor for the Work under contract with the Contractor or Subcontractor shall submit final lien waivers. The lien waivers shall be for the full amount of the Contract involved.

3.4 RECORD DOCUMENTS

A. General

1. When conflict occurs between various technical specification sections and this Section 23 0900/ Basic Temperature Control Requirements, the more stringent requirements shall govern.
2. Each Contractor shall maintain at the site for Owner one record copy of all drawings, specifications, addenda, approved shop drawings, change orders, and other modifications, in good order and marked to record all changes applicable to the work made during construction. All changes made during construction shall be recorded by the Contractor. Contractors shall be responsible for accuracy of all changes made.
3. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.
4. Failure to keep accurate records of equipment installed will require the Contractor to site verify the installation as required/ all at Contractor's expense.

B. Recording

1. Legibly mark and record at each Product section of the Project Manual a description of actual Products installed, including the following:
 - a. Manufacturer's name and product model and number.
 - b. Product substitutions or alternates utilized.
 - c. Changes made by Addenda and Modifications.
2. Record Drawings: Legibly mark to record actual construction:
 - a. Location of devices (sensors, actuators, controllers, etc.) internal utilities (including conduit routing), and appurtenances, concealed in construction or not readily observable from floor level, referenced to visible and accessible features of structure.
 - b. Changes of dimension and detail.
 - c. Details not on original Contract Drawings.
 - d. Modifications/additions to original electrical and pneumatic interface schematics.

C. Submittal

1. During the first week of each month, Contractor shall present, at the project site, the job copy showing variations and changes to date to Owner for review.
2. At completion of Project, submit copies on disk of Project Record Documents to Owner. Project Documents shall contain Project Documents indicating all changes made during construction. Accompany submittal with transmittal letter, in duplicate containing:
 - a. Date
 - b. Project title and address
 - c. Contractor's name and address
 - d. Title and number of each record document
 - e. Certification that each document as submitted is complete and accurate.
 - f. Signature of Contractor or his authorized representative.

3.5 OPERATING AND MAINTENANCE (O & M) MANUALS

- A. Contractor shall also provide required quantity of O&M manuals for Owner Training as specified in Division 01.
- B. The format and information contained in the new O & M manuals will be as follows:
 1. Format
 - a. Binders: Commercial quality/ 8½" x 11" three-ring binders with hardback, cleanable, plastic covers; one inch maximum ring size. Use multiple binders as required.
 - b. Front cover and binding: Identify each binder with typed title.
 - c. Tab Dividers: Provide tabbed fly leaf for each separate product, system or subject with typed description.
 - d. Table of Contents: Provide table of contents for each volume.
 - e. Project Record Drawings: Reduce AutoCAD drawings to 11" x 17" format, provide with reinforced punched binder tab. Bind in with text; fold drawings to size of text pages. (Larger drawing will be allowed if 11" x 17" format is unreadable.)
 2. Volume 1 Hardware
 - g. Section 1:
 - (1) Include all submittals and drawings updated to as built conditions.
 - (2) Include manufacturer's operation and installation instructions for items such as modems, printers, CRTs, computers, keyboards, etc.
 - h. Section 2:
 - (1) Field hardware, product literature.
 - i. Section 3:
 - (1) Controller product catalogs, controller panels, electronic cards, components, etc.
 3. Volume 2 Custom Software
 - a. Section 1 -Software. Provide print outs of all software programming files, including but not limited to all point logs, alarm logs, points with attributes, engineering unit file, programs, message file, etc. Provide software submittals including flow charts and description of operation updated to as built conditions.

- b. Section 2 -Control. Provide software submittals including flow charts and description of operation updated to as built conditions.
- c. Section 3 -Users Summary Catalog. Provide important information which operators would be expected to use on a day by day basis. Work with Owner in defining exact material to be included in this manual.
 - B. Provide electronic copies of all job software on disks which can be directly loaded by Owner.
 - C. All drawings, applications software and other job documentation will become the property of Owner.
 - D. Distribution of O&M manuals will be by Owner.

3.6 TRAINING

- A. Contractor shall provide one (1) training session during the Contract period. Training shall be coordinated with the Owner such that personnel from all three working shifts are available.
- B. One month prior to training, the Contractor shall provide an outline of all topics to be covered in all sessions for approval by Owner.
- C. The instructor(s) shall be competent and have full knowledge of the system installed and shall provide training specifically oriented to Owner's installed system.
- D. The instructor(s) shall utilize the operating and maintenance manual provided for the system as a reference manual during the training session. Each person attending the training session shall be provided with an O&M manual. At minimum, these sessions shall include the following:
- E. Description of the overall control system configuration and physical layout, indicating location of all sensors and controlled devices.
 - 1. Description of all programs and program features (software).
 - 2. Description of the control strategies being utilized at the installation.
 - 3. Description of all key hardware components utilized in the system.
 - 4. Demonstration of how to communicate with (command and monitor) the DDC and ASC Controller(s).
 - 5. Demonstration of the programming instructions required to use the system.
 - 6. Demonstration of how to retrieve alarms and logs.
 - 7. Demonstration of diagnostic trouble-shooting techniques for the system.
 - 8. Description of any changes made to existing electric and pneumatic controls which remain.
 - 9. Provide quick reference card for operator ease of operation.

3.7 DDC PREVENTIVE MAINTENANCE AND REPAIR

- A. All new components shall be incorporated into existing maintenance contract. Bid shall include maintenance costs for new components until end of current maintenance contract.
- B. Systems and components covered by this contract shall include:
- C. All new digital and electric controls associated with the systems in each corresponding Bid.

- D. Proposals shall be on the Contractor's standard form and schedules including:
 - 1. Maintenance schedules or check-off lists for each of the various types of equipment to be supplied. Schedules will give both the servicing tasks and task frequency.
- E. Online and On-Site Troubleshooting and Diagnostics
 - 1. Maintain existing services.
- F. Software Services
 - 1. Maintain existing services.
- G. Preventative Maintenance
 - 1. Maintain existing services.
- H. Corrective Maintenance, Repair and Component Replacement
 - 1. Include cost of all labor and material.
- I. Operator Training
 - 1. Make recommendations for additional training of system operators. Indicate type of training suggested: written texts, video tape, off-site classroom, on-site classroom, etc.
- J. Response Window and Response Time
 - 1. Maintain existing services.
- K. Service Documentation and Quality Assurance
 - 1. Provide documentation of all service calls, including time, date and brief description of activity. Each PM work order will include inspection date, individual to report to, equipment identification, equipment location, work to be performed, and any special instructions.

END OF SECTION

SECTION 23 2113 HYDRONIC PIPING AND SPECIALTIES

PART 1 -GENERAL

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1.1 SCOPE OF WORK

A. Hydronic pipe and fitting materials, joining methods, valves, and specialties in this section include:

1. Chilled water piping

B. Services provided:

1. Pipe pressure testing

1.2 DEFINITIONS

A. CWP: Cold working pressure

B. EPDM: Ethylene propylene copolymer rubber

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber

D. NRS: Non-rising stem

E. OS&Y: Outside screw and yoke

F. PTFE: Polytetrafluoroethylene

G. RS: Rising stem

H. SWP: Steam working pressure

1.3 CODES AND STANDARDS (USE LATEST EDITIONS)

A. American Welding Society (AWS)

1. AWS A5.8: Specification for Filler Metals for Brazing and Braze Welding
2. AWS D1.1/D1.1M: Structural Welding Code -Steel
3. AWS D10.12/D10.12M: Guide for Welding Mild Steel Pipe

B. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1: Pipe Threads, General Purpose, Inch
2. ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings
3. ASME B16.3: Malleable Iron Threaded Fittings
4. ASME B16.4: Cast Iron Threaded Fittings
5. ASME B16.5: Pipe Flanges and Flanged Fittings, NPS1/2 to NPS24
6. ASME B16.10: Face-to-Face and End-to-End Dimensions of Valves
7. ASME B16.15: Cast Bronze Threaded Fittings.
8. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
9. ASME B16.21: Nonmetallic Flat Gaskets for Pipes Flanges
10. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
11. ASME B16.23: Cast Copper Alloy Solder Joint Drainage Fittings -DWV.
12. ASME B16.24: Bronze Flanges and Flanged Fittings.
13. ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings -DWV.
14. ASME B16.34: Valves – Flanged, Threaded and Welding End
15. ASME B16.39: Malleable Iron Threaded Pipe Unions
16. ASME B18.2.1: Square and Hex Bolts and Screws -Inch Series
17. ASME B31 Series: Code for Pressure Piping
18. ASME B31.1: Power Piping
19. ASME B31.9: Building Services Piping
20. ASME Boiler and Pressure Vessel Code: Section IV, "Heating Boilers"; Section VIII, "Pressure Vessels," Division 1; Section IX, "Welding and Brazing Qualifications"

C. American Society of Mechanical Engineers (ASTM)

1. American Society for Testing Materials (ASTM)
2. ASTM A 47/A 47M: Specification for Ferritic Malleable Iron Castings
3. ASTM A48/A 48M: Specification for Gray Iron Castings
4. ASTM A 53/A 53M: Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
5. ASTM A 106: Specification for Seamless Carbon Steel Pipe for High-Temperature Service
6. ASTM A 126: Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
7. ASTM A 234/A 234M: Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Services
8. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
9. ASTM A 395/A 395M: Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
10. ASTM A 536: Specification for Ductile Iron Castings
11. ASTM A 733: Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
12. ASTM B 32: Specification for Solder Metal
13. ASTM B 61: Specification for Steam or Valve Bronze Castings
14. ASTM B 62: Specification for Composition Bronze of Ounce Metal Castings
15. ASTM B 75: Specification for Seamless Copper Tube
16. ASTM B 88: Specification for Seamless Copper Water Tube
17. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)
18. ASTM B 584: Specification for Copper Alloy Sand Castings for General Applications
19. ASTM B 813: Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
20. ASTM B 828: Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
21. ASTM D 1785: Specification for PolyVinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
22. ASTM D 2466: Specification for PolyVinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
23. ASTM D 2467: Specification for PolyVinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
24. ASTM D 2564: Specification for Solvent Cements for PolyVinyl Chloride (PVC) Plastic Piping Systems
25. ASTM D 2672: Specification for Joints for IPS PVC Pipe Using Solvent Cement
26. ASTM D 2846/D 2846M: Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot-and Cold-Water Distribution Systems
27. ASTM D 2855: Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
28. ASTM F 402: Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermostatic Pipe and Fittings
29. ASTM F 438: Specification for Socket-Type Chlorinated PolyVinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
30. ASTM F 439: Specification for Socket-Type Chlorinated PolyVinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
31. ASTM F 441/F 441M: Specification for Chlorinated PolyVinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80
32. ASTM F 493: Specification for Solvent Cements for Chlorinated PolyVinyl Chloride (CPVC) Plastic Pipe and Fittings
33. ASTM F 656: Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D. American Water Works Association (AWWA)

1. AWWA C606: Grooved and Shouldered Joints

E. Brazing Handbook.

F. Manufacturers Standardization Society (MSS)

1. MSS SP-45: Bypass and Drain Connections
2. MSS SP-58: Pipe Hangers and Supports -Materials, Design and Manufacture
3. MSS SP-67: Butterfly Valves
4. MSS SP-68: High Pressure Butterfly Valves with Offset Design
5. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
6. MSS SP-71: Gray Iron Swing Check Valves, Flanged and Threaded Ends
7. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends for General Service
8. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
9. MSS SP-80: Bronze Gate, Globe, Angle and Check Valves
10. MSS SP-85: Gray Iron Globe and Angle Valves, Flanged and Threaded Ends
11. MSS SP-107: Transition Union Fittings for Joining Metal and Plastic Products
12. MSS SP-108: Resilient-Seated Cast Iron-Eccentric Plug Valves
13. MSS SP-110: Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
14. MSS SP-122: Plastic Industrial Ball Valves
15. MSS SP-125: Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves

1.4 QUALITY ASSURANCE

- A. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling, or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3 foot intervals.
- B. Fittings: To be identified by the manufacturer by permanently attached tags, imprints, or other approved means, indicating the class of wall thickness and material.
- C. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
- E. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
- F. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9 and applicable state labor regulations.
 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- G. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code -Steel."
- H. Qualifications for Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by the manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.
- I. All grooved piping products shall be supplied by a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. Grooving procedures shall be in accordance with the manufacturer's current listed standards conforming to ANSI/AWWA C606.

1.5 SUBMITTALS

- A. Product Data: Submit for each type of the products as listed below. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model, and dimensions.

1. Pipe materials and fittings
 2. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated balancing valves and automatic flow control valves.
 3. Air control devices
 4. Hydronic specialties
 - i. Shop Drawings: For all new piping systems submit layout drawings at $\frac{1}{4}''=1'0''$ scale in both hard-copy and AutoCAD compatible format. Shop drawings shall include, but not be limited to:
 - ii. Piping layout indicating sizes and locations
 - b. Elevations of piping
 5. Slopes of horizontal piping
 6. Wall and floor penetrations
 7. Pressure rating for each service
 8. Penetrations through fire-rated and other partitions, floors, etc.
 9. Equipment installation and connections based on the equipment being used on the Project
 10. Hangers and supports including multiple pipe hangers
 11. Location of alignment guides, expansion joints, and anchors, including attachment to building structure
 12. Shop drawings shall show other building and building system components for coordination purposes. Input from other installers shall be obtained. Any proposed changes to piping layout required for coordination purposed shall be indicated. Coordination items shown shall include but no be limited to:
 13. Any pipe (e.g. sprinkler, plumbing pipes, roof drains, etc.) in vicinity of hydronic piping
 - a. Electrical equipment, duct banks, and conduit
 - b. Structural members, including structural members to which piping supports and anchors will be attached
- B. Pipe Testing Submittals and Reports
1. Submit documentation of pipe pressure testing and submit test result reports within two weeks of testing.
 2. Contractor shall be responsible for any corrective action required due to a failed pipe pressure test.
- C. Manufacturer's Installation Instruction: Submit manufacturer's installation instructions for all manufactured products and assemblies required for this project.
- D. Welding certificates
- E. Operation and Maintenance Data: Include installation instruction, assembly views, lubrication instructions, and replacement parts list. For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
- F. Final Record Drawings
1. During the construction process, the Contractor shall maintain a set of drawings showing the exact routing and location of piping systems being installed. The drawing shall be updated neatly by hand on a daily basis and account for routing modifications made in the field. Contractor shall use these drawing as a basis for generating the project as-built drawings.
- G. As-Built Drawings
1. Upon completion of project, Contractor shall furnish as-built drawings showing in scale the exact routing and locations of all newly installed piping systems.

Submit in both hard-copy and electronic AutoCAD format.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect new pipe interiors from moisture, construction debris and dust, and other foreign materials with the use of plastic end caps/plugs on each end of pipe. Maintain end-caps/plugs in place until piping is installed.
- B. Store materials indoors, protected from the weather. Where exterior storage is necessary, elevate piping above grade and enclose with waterproof wrapping or cover.
- C. Deliver and store valves in shipping containers with labeling in place.
- D. Replace any piping or devices which are damaged during shipping or storage.

1.7 SPARE PARTS

- a. Not Applicable

1.8 WARRANTY

- A. One year warranty on products and complete installation commencing at the time of Substantial Completion

1.9 MAINTENANCE

- b. Not Applicable

County of Champaign Hydronic Piping and Specialties Brookens Chiller Replacements Section 23 2113 -5

PART 2 -PRODUCTS

2.1 CHILLED WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Grade B, Type E or S, Schedule 40, black steel with plain ends. Pipe 12" and over shall be standard weight, 0.375" wall thickness.
 - 1. Fittings and Joints
 - a. 2" and smaller: ANSI/ASTM B16.3 Class 150 malleable iron or ANSI/ASTM B16.4 Class 125 cast iron fittings. Threaded joints.
 - b. 2-1/2" and larger: ASTM A234, wrought steel welding type fittings. ANSI/AWS D1.1 welded joints.
 - 2. Flanges and Flanged Fittings
 - a. ANSI/ASME B16.1, Class 125 raised face cast iron flanges
 - b. ANSI/ASME B16.5, Class 150 forged steel, raised face, welding neck flanges
 - c. Flanges to match those on valves and equipment
 - d. Slip-on steel flanges not allowed.

1.2 FLANGES, UNIONS AND COUPLINGS

- A. Steel Pipe
 - 1. Unions 2" and Smaller: ANSI/ASME B16.39 malleable iron unions for threaded pipe, ground joint, screwed bronze or brass to iron. Pressure class and joint type of union shall be equal to that specified for fittings of respective piping service.
 - 2. Flanges 2 ½" and Larger: ANSI/ASME B16.5, forged steel, raised face, welding neck flanges. Pressure class and joint type of flange shall be equal to that specified for fittings of respective piping service.
 - 3. Slip-on flanges are not allowed.
- B. Flanges to match those on valves and equipment.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated
- D. Pipe-Flange Gasket Materials
 - 1. Suitable for chemical and thermal conditions of piping system contents.
 - 2. ASME B16.21, nonmetallic, flat, asbestos free, 1/8" maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges

2.3 DIELECTRIC FITTINGS

- A. Dielectric Nipples 4" and Smaller
 - 1. Acceptable Manufacturers: Flow Design Inc., Perfection Corporation, Victaulic.
 - 2. Electroplated steel nipple with inert and non-corrosive thermoplastic lining; threaded or grooved ends, 300-psig minimum working pressure at 225°F meeting the requirements of ASTM F-492. Clearflow dielectric waterway fittings as manufactured by Perfection Corporation.

2.4 GLOBE VALVES

- A. Acceptable Manufacturers
 - 1. Crane
 - 2. Hammond
 - 3. Milwaukee
 - 4. Nibco

- B. Up to 2": Class 150, 300 psig CWP rated, manufactured in accordance with MSS-SP-80. ASTM B62 bronze body, union bonnet, bronze trim, rising bronze stem, malleable iron handwheel, asbestos free packing, renewable composition PTFE of TFE disc, screwed ends. Model 590T manufactured by Milwaukee.
- C. 2½" and greater: Class 125, 200 psig CWP rated manufactured in accordance with MSSSP-85. ASTM A126 iron body, bolted bonnet, bronze trim, rising stem, cast iron handwheel, asbestos free packing OS&Y, solid disc, flanged end. Model F-2981-M manufactured by Milwaukee.

2.5 BALL VALVES

- A. Acceptable Manufacturers
 - 1. Apollo
 - 2. Crane
 - 3. Hammond
 - 4. Milwaukee
 - 5. Nibco
 - 6. Watts Regulator
- B. Up to 2½": 600 psi CWP rated, manufactured in accordance with MSS-SP-110. Two-piece bronze body, stainless steel full port vented ball, PTFE or TFE seats, lever handle and threaded ends. Model T-585-70-66 manufactured by Nibco.
- C. Ball valves mounted in insulated pipes shall have 2" extended stems of non-thermal conductive material to clear pipe covering, and a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing insulation.

2.6 BUTTERFLY VALVES – RESILIENT SEATED

- A. Acceptable Manufacturers
 - 1. Bray
 - 2. DeZurik
 - 3. Keystone/Tyco
 - 4. Milwaukee
 - 5. Nibco
- B. Standard Pressure Butterfly Valves:
 - 1. 2 ½" to 6" O 175 psi close off pressure at temperatures up to 225°F, manufactured in accordance with MSS-SP-67, suitable for bi-directional dead-end service at rated pressure without use of downstream flange. Cast iron or ductile iron body with lug ends, aluminum bronze or Nylon 11 coated ductile iron disc, blowout proof stainless steel stem, peroxide cured EPDM seat bonded or vulcanized to the body, for service to 250°F, extended neck for insulating, 10 position lever handle for valves up to 6" in size. Series 31 manufactured by Bray.
 - 3. Valves 8" and larger shall be furnished with handwheel and gear drive.
 - 4. Valves 14-20" O Same as above/ except 150 psi rated at temperatures up to 225°F.
- C. Provide chain operators for valves 8" and over installed 8'-0" or more above floor in mechanical rooms.

2.7 AIR VENTS

- A. Acceptable Manufacturers
 - 1. Amtrol
 - 2. Armstrong
 - 3. Bell and Gossett
 - 4. Taco
- B. Manual Type: Bronze body, threaded inlet connection, with 1/8" brass needle valve at top of chamber. Class 125, 150 psig CWP rated, maximum operating temperature 225°F.
- C. Automatic Float Type: Bronze or cast iron body, stainless steel float, stainless steel valve and valve seat. Class 125, 150 psig CWP rated, maximum operating temperature 225°F. Model 107A manufactured by Bell and Gossett.

PART 3 -EXECUTION

3.1 INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated piping locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes. Install piping at a uniform grade of 0.2 percent upward in direction of flow when not other slope is indicated on the drawings.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install groups of pipes at common elevations, parallel to each other, spaced to permit applying insulation and servicing of valves.
- J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- K. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
 - 1. The use of saddle or "cut-in" connections is NOT allowed.
 - 2. The use of T-Drill connections is NOT allowed.
- L. The use of bullhead tee connections, where two opposite flows join to a common perpendicular outlet, is NOT allowed.
- M. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- N. Install pipe wells for temperature controls sensors and instrumentation. Coordinate with temperature controls contractor.

O. Pipe Joint Construction

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
7. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
8. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 - d. PVC Non-Pressure Piping: Join according to ASTM D 2855.

P. Coordination of mechanical work installation and access requirements:

1. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Owner and General Contractor.
2. Where pipes are to be installed in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space.
3. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for work and also furnish information and shop drawings necessary to permit installation of other work without delay.
4. Where there is evidence that parts of Mechanical Work will interfere with other work, assist in working out space conditions and/or structure, and make necessary adjustments to accommodate work.
5. Mechanical Work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.
6. Install Mechanical work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.
7. Arrange pipes, ducts and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear the openings of swinging and overhead doors and of access panels.
8. Provide access panels in equipment, ducts and like items for inspection of interiors and proper maintenance.

Q. Appliances and equipment to be installed and connected with best engineering practices and in accordance with manufacturer's instructions and recommendations. Piping, valves, connections and other

like items recommended by manufacturer or as required for proper operation to be provided without additional cost to Owner.

- R. In no case will any pipe, conduit or duct be installed where it is supported on or suspended from another pipe, conduit or duct.
- S. Follow manufacturers' directions in installation and operation of all equipment and materials.
- T. Indirect waste lines, cooling coil drain pan lines, overflow pipes, relief valve discharge pipes, etc. shall have ends beveled at 45° angle to minimize splashing.
- U. After completion or piping installation, clean, flush, and treat systems. Coordinate with chemical treatment requirements; refer to Division 23 Section 23 2500/ "Pipe Cleaning, Flushing, and Chemical Treatment."
- V. Valves
 1. Examine valve interior for cleanliness. Clean or replace as required.
 2. Remove special packing materials from valves.
 3. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by valve operation.
 4. Install valves with stems upright or horizontal, not inverted.
 5. Install valves in position to allow full movement and operation.
 6. Install chainwheels on operators for butterfly and other shut-off valves sizes 8" and over/ installed 8'-0" or more above floor in mechanical rooms.
 7. Install swing check valves in horizontal position with hinge pin level.

3.2 APPLICATIONS

- A. Select system components with pressure rating equal to or greater than system operating pressure.
- B. Install unions in piping 2" and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- C. Install flanges in piping 2½" and larger, at final connections of equipment and elsewhere as indicated.

- D. Install drains, consisting of a tee fitting, ¾" ball valve, and short threaded nipple with cap, at main shut-off valves, low points of piping, bases of vertical risers, at equipment and elsewhere as required for system drainage.
- E. Provide manual air vents where shown on drawings and all high point of water systems, at heat transfer coils and elsewhere as required for air venting. Where large air quantities can accumulate in piping systems, provide enlarged air collection chambers.
- F. Provide non-conducting dielectric fittings wherever joining dissimilar metals.
- G. Piping to equipment shall be installed full size as indicated on the plans. If equipment connections differ from piping shown on the drawings, provide reducers/increasers at all valves, devices, and equipment as required.

3.3 WELDING

- A. All welding shall be performed by experienced welders in a neat and workmanlike manner. Welding done on piping, pressure vessels and structural steel under this section shall be performed only by persons who are currently qualified in accordance with ANSI Standard Code for Pressure Piping, Section I, Power Piping, Bulletin ANSI B31.1.0-1980; applicable portions of ASME Boiler and Pressure Vessel Code, Section I, Power Boilers, and Section IX, Welding Qualifications. Submit for approval and record certified copies of Procedure Specification for Welding, Welding Procedure Qualification Tests and Welder Performance Qualification Tests. Welding specifications and qualification tests shall be recorded on Forms Q-1 as recommended in Appendix II of Section IX of the ASME Boiler and Pressure Vessel Code. Records shall be certified by Contractor and shall be accessible to authorized inspector.
- B. Bevel piping on both ends before welding as required and defined in Code.
- C. Use following weld spacing on all butt-welds:

Nominal Pipe Wall Thickness	Space
¼" or less	⅛"
Over ¼" or less than ½"	3/16"
½" and over	3/16"

- D. Use backing rings on welds in all piping 10" and larger.
- E. Where welding branches or connections are taken from a branch or main and the branch or connection pipe size is the same diameter as the main, a welding tee must be installed in the main for the branch or connection. Saddle or cut-in connections are NOT allowed.
- F. Where branches or connections are made to a welded main and the branch or connection is a minimum of two pipe sizes less than the diameter of the main, and the branch is 2 ½" and larger, install a Bonney-Forge weldolet at the branch connection to the main. Where the branch or connection is 2" and smaller, install a Bonney-Forge threadolet at the branch connection to the main. Screwed couplings, half couplings or screwed nipples welded to mains for screwed branches will not be permitted.
- G. The method of attaching weldolet or threadolet units to the piping shall be in strict accordance with the ANSI Code for Pressure Piping, B31.1.
- H. Before start of any welding, remove all corrosion and other foreign material from surface to be welded.
- I. Welding shall be performed by either manual shielded metallic arc process or automatic submerged arc process. Use direct current exclusively.

- J. Electrodes to be used with manual shielded metallic arc method shall conform to ASTM A-233, Classification E-6010.
- K. Size of electrodes, voltages, current, thickness, and number of passes or beads shall be in accordance with provisions of previous paragraph.
- L. After deposition, clean each layer of weld metal to remove all slab and scale by wire brushing or grinding, then chip where necessary to prepare for proper deposition of next layer.
- M. Weld reinforcement shall be not less than 1/16" or more than 1/8" above normal surface of joined sections. Reinforcement shall be crowned at center and shall taper on each side to surface being joined. Exposed surface of weld shall present workmanlike appearance and shall be free of depressions below surface of joined members.
- N. No welding of any kind shall be done when temperature of base metal is lower than 0°F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Temperature of metal shall be "warm to hand"— or approximately 60°F.
- O. All welders engaged in work performed under this Section shall have been qualified in accordance with test requirements of Section IX of the ASME Boiler and Pressure Vessel Code. Each operator shall identify his production welds by marking his regularly assigned identification number or mark within 1" of weld. Contractor shall submit complete list of individual numbers of identifying marks and operator's name, and a copy of each operator's certificate.

3.4 TESTING

- A. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing under test and repeat the tests until no defects are disclosed; leave the equipment clean and ready for use.
- B. Field test all piping before start-up of systems. Tests of piping systems shall be conducted before connections to equipment are made and before piping is covered, buried or otherwise concealed.
- C. Perform all tests other than herein specified which may be required by legal authorities or by agencies to whose requirements this work is to conform.
- D. Furnish all necessary testing apparatus, make all temporary connections and perform all testing operations required, at no additional cost to Owner.
- E. No work shall be insulated, painted, backfilled or concealed until authorized by Owner's representative and/or the Engineer representative.
- F. Inform Engineer and Owner's representative 48 hours prior to when work is ready for test.
- G. Systems found to have leaks shall be subjected to further tests when faulty joints have been repaired or replaced.
- H. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- I. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing. Submit to Owner and Engineer.
- J. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, and cooling towers, to specified values.
 7. Verify lubrication of motors and bearings.
- K. Test pressures shall be increased if necessary to comply with applicable codes.

END OF SECTION

SECTION 23 2500 PIPE CLEANING, FLUSHING AND CHEMICAL TREATMENT

PART 1 -GENERAL

1.1 SECTION INCLUDES

- A. Cleaning of piping systems
- B. Chemical feeder equipment
- C. Treatment for closed systems

1.2 SUBMITTALS

- A. Submit product data indicating chemical treatment materials, chemicals and equipment. These items shall match Owner's existing standards
- B. Submit manufacturer's installation instructions
- C. Submit manufacturer's field reports
- D. Submit reports indicating start-up of treated systems have been completed and are operating properly.
- E. Submit reports indicating analysis of system water after cleaning and after treatment.

1.3 OPERATION AND MAINTENANCE DATA

- A. Include data on chemical feed pumps, agitators and other equipment including spare parts lists, procedures and treatment programs.
- B. Include step by step instructions on test procedures including target concentrations.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and for discharge to public sewage systems.

1.6 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.
- B. Provide on-site inspections of equipment during scheduled shutdown to properly evaluate success of water treatment program and make recommendations in writing based upon these inspections.

1.7 MAINTENANCE MATERIALS

- A. Provide sufficient chemicals for treatment and testing during warranty period.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

2.2 MATERIALS

- A. All materials proposed must be compatible with existing treatment systems and chemicals.
- B. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
 - 2. Algaecide.
- A. Closed System Treatment (Water):
 - 1. Sequestering agent to reduce deposits and adjust pH.
 - 2. Corrosion inhibitors.
 - 3. Conductivity enhancers.

2.3 EQUIPMENT

- a. Not Applicable

PART 3 -EXECUTION

3.1 PREPARATION

- A. Systems shall be operational, filled, started and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in OPEN position during cleaning.

3.2 CLEANING SEQUENCE

- A. Add cleaner to closed systems at concentration as recommended by manufacturer.
- B. Chilled Water Systems: Circulate for 48 hours, then drain systems as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
- C. Remove, clean and replace strainer screens.
- D. Inspect, remove sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and with Owner's present practice.

3.4 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.
- C. Provide ¾" water coupon rack around circulating pumps with space for four

3.5 FIELD INSPECTION AND REPORT

- A. Provide report, in accordance with Division 01 Section 01 4000, "Quality Requirements," prepared by manufacturer's representative, stating that systems installed and services provided under this Section are in accordance with manufacturer's recommendations and are properly operating.

END OF SECTION

SECTION 23 6423 AIR-COOLED CHILLERS

PART 1 -GENERAL

1.1 SCOPE OF WORK

- A. Products provided in this section include:
 - 1. Air-cooled chillers
 - 2. Charge of refrigerant and oil
 - 3. Building automation system (BAS) interface
 - 4. Vibration isolators
 - 5. Sound attenuation package(s)

- B. Services provided in this section include:
 - 1. Factory functional testing
 - 2. Manufacturer's field services
 - 3. BAS integration
 - 4. Maintenance agreement

- C. Remove and properly dispose of the two (2) existing air cooled chillers. Furnish and install two chillers of the same capacity in the same location. Include replacement of existing electrical at chiller in base bid.
 - 1. Existing chiller 1 (east) is Carrier model 30GB100550AA
 - 2. Existing chiller 1 (west) is Carrier model 30GB090550AA

- D. Each chillers must have qualify for a DCEO standard incentive for air cooled chillers, verify current requirements at time of bid (i.e. min IPLV of 0.86 or better for an air cooled chiller) A manufacturer's specification data sheet must be submitted with bid showing the IPLV rating and capacity to qualify

- E. Alternate bids:
 - 1. Provide a price to replace existing exterior piping insulation at chillers with 1" insulation (armaflex or equivalent) and PVC sealed PVC jacket
 - 2. Provide pricing to pull new power wire and modifications to distribution system as required if power requirements exceed present service conditions from main service to new chillers.

1.2 DEFINITIONS

Not Applicable

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1.3 CODES AND STANDARDS (UTILIZE MOST RECENT VERSION)

- A. Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
 - A. AHRI 370: Sound Performance Rating of Large Air-Cooled Outdoor Refrigerating and Air-Conditioning Equipment
 - B. AHRI 550/590: Water Chilling Packages Using the Vapor Compression Cycle
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers
 - C. ASHRAE 15: Safety Standard for Refrigeration Systems
 - D. ASHRAE 34: Designation and Safety Classifications of Refrigerants
 - E. ASHRAE 90.1: Energy Standard for Buildings except Low-Rise Residential Buildings
 - F. ASHRAE 147: Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
- C. American Society of Mechanical Engineers (ASME) Section VIII: Boiler and Pressure Vessel Code
- D. American Society for Testing and Materials (ASTM) B-117: Standard Practice for Operating Salt Spray (Fog) Apparatus
- E. Institute of Electrical and Electronic Engineers (IEEE) 519: IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- F. International Organization for Standardization (ISO) 9001: Standard for Manufacturing Quality
- G. National Fire Protection Association (NFPA) 70: National Electric Code (NEC)
- H. NEMA 250: Enclosures for Electrical Equipment
- I. NEMA AB-1: Molded-Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures
- J. NEMA ICS 2: Industrial Control and Systems: Controllers, Contactors, and Overload Relays
- K. NEMA ICS 6: Industrial Control and Systems: Enclosures
- L. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches
- M. NEMA MG 1: Motors and Generators
- N. Occupational Safety and Health Act (OSHA)
- O. Underwriters Laboratories Inc. (UL) 1995: Heating and Cooling Equipment

1.4 QUALITY ASSURANCE

- A. Conform to all national, state, and local codes.
- B. Comply with UL and UL Canada and include a compliance label by a qualified testing agency.
- C. Chiller components shall be constructed, tested, and stamped in accordance with applicable ASME codes.
- D. Conform to ASHRAE 15: Safety Code for Mechanical Refrigeration.
- E. Conform to NFPA 70: National Electrical Code.
- F. Chiller shall be manufactured in a facility registered to ISO 9001 or ISO 9002.
- G. Chiller performance shall be rated and certified in accordance with AHRI 550/590.
- H. Chiller sound data shall be rated and certified in accordance with AHRI 370.
- I. Chiller painted components shall be capable of withstanding 500 hour salt spray test in accordance with ASTM B-117.
- J. Chiller shall be functionally tested at the factory with water flowing through the chiller.
- K. Chiller startup services shall be performed by factory trained personnel.

1.5 SUBMITTALS (SUBMIT WITH BID)

- A. Submittals shall indicate components, dimensions, weights and point loads, required clearances and location and size of field connections.
- B. Provide product data indicating rated capacities, specialties and accessories, electrical requirements and wiring diagrams.
- C. Submit complete performance and sound data at full and part load capacities per the table below. In addition, provide full load and part load ratings at AHRI conditions.
- D. Submit manufacturer's installation and operation instructions and spare parts list.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's installation instructions for storage, rigging, unloading and transporting units.
- B. Provide protective covering over entire chiller and piping connections. Protective covering shall remain until chiller is installed.
- C. Unit controls shall be capable of withstanding 150°F storage temperature in the control compartment.

1.7 SPARE PARTS

- A. Provide recommended spare parts list as part of submittal package.

1.8 WARRANTY

- A. Provide one (1) year parts and labor warranty on chiller package including materials, labor, and refrigerant from date of startup.

1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance for one year from **date of startup**.
- B. The maintenance agreement shall cover all preventive maintenance and service during regular work hours as outlined below:
 - 1. Cooling Season Preparation and Inspection
 - a. Check refrigerant and oil levels.
 - b. Check oil sump, oil heaters and temperatures.
 - c. Check and test all operating and safety controls.
 - d. Check the starter operation.

- e. Start the chilled water pump.
 - f. Start the chiller and calibrate controls.
 - g. Leak check the unit and identify leak sources for repair.
 - h. Log operating conditions after system and unit stabilized.
 - i. Review operating procedures and Owner=s log with operator.
 - j. Check auxiliary equipment operation.
2. Four inspections during the Cooling Season (April, June, August, October)
- a. Inspect chiller and adjust safety controls.
 - b. Inspect condenser coils and clean as needed per manufacturer's instructions.
 - c. Check operation of controls.
 - d. Check oil and refrigerant levels.
 - e. Check operation of lube system.
 - f. Check the oil return system.
 - g. Check operation of motor and starter.
 - h. Record operating conditions.
 - i. Check log and review chiller and system operation with operator.
 - j. Conduct routine maintenance as recommended and required.
 - k. Log and report repairs and parts that are required.
3. Annual Equipment Shutdown Inspection and Preventative Maintenance
- a. Check the compressor-motor assembly for the following items and perform tasks as indicated:
 - Record voltages.
 - Meg test and record motor winding resistance.
 - Lubricate motor. S Check seals.

3. Check the compressor oil system for the following items:
 - a. Conduct analysis on oil and oil filter at an independent laboratory.
 - b. Check oil pump, seal and motor.
 - c. Cleaning the dirt leg.
 - d. Check heater and thermostat.
 - e. Check all other oil system components including cooler, strainer and solenoid valve where applicable.
4. Check variable frequency drive (if applicable) and perform the following
 - f. tasks:
 - g. S Run diagnostic check.
 - h. S Clean contacts or recommend replacement.
 - i. S Check linkage.
 - j. S Meg test the motor.
 - k. S Check all terminals and tighten connections.
 - l. S Check overloads, dash pot oil and calibrate.
 - m. S Inspect and clean heat rejection device, as required.
 - n. S Dry run starter (or before start-up); check status.
5. Review the control panel for the following items:
 - o. Run diagnostic check of micro control panel.
 - p. Check safety shutdown operation.
 - q. Check all terminals and tighten connections.
 - r. Check display data accuracy and set points.
6. Check the condenser for the following items:
 - s. Clean condenser coils per manufacturer's instructions. **Do not pressure wash or use chemicals unless recommended by manufacturer.**
7. Check the cooler for the following items:
 - t. Check the water flow.
 - u. Check flow switch operation.
 - v. Check refrigerant level.
 - w. Remove evaporator head and inspect end sheets.
8. Check the system for the following items:
 - x. Conduct a leak check and identify leak sources for repairs.
 - y. Verify proper operation of purge and perform periodic purge preventive maintenance (e.g., replacement of filter/drier).
 - z. Record condition of sight glasses.
 - aa. Check the refrigerant cycle to verify the proper operating balance.
 - bb. Check chilled water heat transfer.
9. General items included:
 - cc. Repair insulation removed for inspection and maintenance procedures.
 - dd. Clean equipment and surrounding area upon completion of work.
 - ee. Consult with operator.
 - ff. Report deficiencies and repairs required.
10. Total Service coverage including labor and materials for repairs and troubleshooting, available during normal business hours (six hours or less response time)

PART 2 -PRODUCTS

Not Applicable

PART 3 -EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on existing steel foundation.
- C. Install units on vibration isolators provided by manufacturer.
- D. Set unit dead level both directions. Check with carpenter level.
- E. Connect to electrical service. Refer to Division 26.
- F. Connect to chilled water piping. Refer to Division 26.
- G. Lubricate fans and motors as recommended by the manufacturer.
- H. Inspect unit condensing coils for damage and repair as necessary.
- I. Check all controls after start-up.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide startup services by factory trained manufacturer's representatives in accordance with Conditions of Contract. Services shall include but not be limited to:
 - a. Inspection of chiller installation to confirm it meets manufacturer's requirements including: overall condition of the chiller, shipping brace removal, operational and maintenance clearances, piping connections, electrical connections, vibration isolator installation, controls integration, and field installed accessories.
 - b. Provide startup of chiller per manufacturer's operation manual
 - c. Provide calculation of estimated energy efficiency ratio (EER) based on operating conditions available to verify chiller performance.
- B. In conjunction with the Controls Contractor, provide a minimum of eight (8) hours of commissioning of the chiller.
 - a. Verify that control wiring is per manufacturer's requirements
 - b. Verify that chiller is communicating with the BAS.
 - c. Verify that all required points have been successfully mapped to the BAS and are calibrated correctly.
 - d. Troubleshoot any communication issues.
- C. On completion of installation of vibration isolators, the local vibration isolator

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3.3 DEMONSTRATION

- A. Provide a minimum of four (4) hours per chiller of systems demonstration and training by factory trained manufacturer's representative in accordance with Conditions of Contract. Coordinate with Owner so that all shifts are included in training.

3.4 FIELD INSPECTION AND REPORT

- A. Provide report in accordance with Conditions of Contract, prepared by manufacturer's representatives for chiller and vibration isolators, stating that systems installed and services provided under this Section are in accordance with manufacturer's recommendations and are properly operating.

END OF SECTION