

**PROJECT MANUAL**  
**FOR**  
**Central Utility Plant**  
**Upgrade Chilled Water**  
**System**

**UNIVERSITY OF CONNECTICUT**  
**STORRS CAMPUS**  
**Storrs, Connecticut**

**PROJECT #901696**



**May 12, 2014**

**ARCHITECT/ENGINEER OF RECORD:**  
**RMF Engineering**

UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696

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**Central Utility Plant Upgrade**  
**Chilled Water System**

**Project #901696**

**Prequalified Contractors**

<b>1</b>	<b>All State Construction, Inc.</b> Farmington, CT
<b>2</b>	<b>O &amp; G Industries, Inc.</b> Torrington, CT
<b>3</b>	<b>The Nutmeg Companies, Inc.</b> Norwich, CT

## **INVITATION TO BID**

May 12, 2014

**DUE DATE: June 10, 2014**

**TIME: 2:00 p.m.**

**LOCATION: University of Connecticut  
Capital Projects & Contract Administration  
3 North Hillside Road, Unit 6047  
Storrs, CT 06269  
Attn: Walt Dalia**

**(Sealed Bids – Faxed Bids will not be accepted)**

The University of Connecticut is accepting sealed bids for:

**Central Utility Plant Upgrade Chilled Water System**

**Project #901696**

**UNIVERSITY OF CONNECTICUT**

**STORRS, CT**

Bids must be submitted on the forms supplied and in the manner specified within the Bid Documents. Bid Documents may be obtained from the University of Connecticut, Office of Capital Project and Contract Administration, 3 North Hillside Road, Unit 6047, Storrs, CT 06269-6047. Please contact Walt Dalia at [walter.dalia@uconn.edu](mailto:walter.dalia@uconn.edu) or by telephone at (860) 486-8047 to request these documents. **This project is open only to those General Contractors who have prequalified for this project.**

### **Project Description**

The purpose of this project is to increase the capacity of the central chilled water system. This work will provide a new steam-turbine driven chiller, a new cooling tower, a new chilled water pump, and a new condenser water pump. Also included will be additional piping, valves, electrical service, and controls. The project will also provide a new elevated refrigerant recovery pumpout receiver. This project will take place in the Central Utility Plant (CUP) which is located on the Storrs Campus of the University of Connecticut, Storrs, Connecticut.

### **PRE-BID CONFERENCE**

There will be a job-site walkthrough on **Wednesday, May 21, 2014 at 9:00 a.m.** This walkthrough is ***not mandatory*** however; interested bidders are ***strongly encouraged*** to attend to view existing conditions. Meet at the **Purchasing Conference Room, 2<sup>nd</sup> floor located at 3 North Hillside Road, Storrs, Connecticut.** The Pre-Bid Conference will commence promptly at the time noted herein. There are limited short-term visitor parking spaces around the Purchasing Building. The North Parking Garage is recommended to all vendors as parking on campus is at your own risk.

### **REQUEST FOR INFORMATION PROCEDURE**

**No questions will be accepted after 2:00 p.m. on Friday, May 30, 2014.** All answers will be published by written Bid Clarification. Extensions of RFI deadlines may only be revised via written Bid Clarification. It is the responsibility of all bidders to verify that they are current with all Bid Clarifications issued with the Office of Capital Projects and Contract Administration prior to bid submission.

**Bids will be accepted at the Office of Capital Project and Contract Administration, 3 North Hillside Road, Storrs, CT 06269 until 2:00 P.M. local time on Tuesday, June 10, 2014 at which time they will be publicly opened and read.**

The Bid shall be accompanied by a Bid Bond in the amount of ten percent (10%) of the amount bid. All bonds required for this Project shall be acceptable to the University and, as a minimum, issued through a bonding company licensed to transact such business in the State of Connecticut and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the "Treasury Department Circular 570".

The successful Contractor shall be required to provide a Labor and Material Payment Bond and a Performance Bond for one hundred percent (100%) of the Contract price.

In the bidding of most deferred maintenance, major renovation, and new construction projects, general contractors are advised they must award twenty-five percent (25%) or more of the values of their awarded contracts to certified SBE's; and, of that amount, twenty-five percent (i.e., 6.25%) or more must be awarded to SBE's who are also MBE's. The general contractors are responsible for ensuring that they and the SBE's they have selected are eligible contractors, and that they meet State requirements

The University reserves the right to reject any or all Bids, in whole or in part, to award any item, group of items, or total Bid, and to waive any informality or technical defects, if it is deemed to be in the best interests of the University.

No Bidder may withdraw its Bid within **ninety (90) days** of the date of the Bid opening. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the University and the Bidder.

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Walt Dalia  
Purchasing Agent II  
Capital Projects and Contract Administration

## **INSTRUCTIONS TO PREQUALIFIED BIDDERS**

### **ARTICLE 1 GENERAL PROVISIONS**

#### **1.1 Connecticut Sales and Use Tax**

- 1.1.1 The University of Connecticut is a tax-exempt institution. The Contractor shall be familiar with the current regulations of the Department of Revenue Service. The tax on materials or supplies exempted by such regulations shall not be included as part of the Bid. A Sales Tax Certificate is available from the Purchasing Department upon written request.

#### **1.2 Contractor's Qualifications**

In the Pre-Qualification to Bid Documents for this project, the University has reserved the right to request additional information from prospective Bidders beyond what may have been submitted in any Application and Statement of Qualifications in response to the Invitation to Pre-Qualify. The University has also reserved the right to find any Bidder to be non-responsible with respect to a specific project notwithstanding the fact that the Bidder may have previously been pre-qualified pursuant to the pre-qualification process. The University reaffirms these reservations of rights. In finding that a Bidder is non-responsible, the University may rely upon any information obtained prior to or subsequent to a finding that Bidder is pre-qualified.

- 1.2.1 CGS 4b-91 Requires each bid submitted shall include a copy of a prequalification certificate issued by the Commissioner of Administrative Services. The bid shall also be accompanied by an update bid statement in such form as the Commissioner of Administrative Services prescribes. The form for such update bid statement shall provide space for information regarding all projects completed by the bidder since the date the bidder's prequalification certificate was issued or renewed, all projects the bidder currently has under contract, including the percentage of work on such projects not completed, the names and qualifications of the personnel who will have supervisory responsibility for the performance of the contract, any significant changes in the bidder's financial position or corporate structure since the date the certificate was issued or renewed, any change in the contractor's qualification status as determined by the provisions of subdivision (6) of subsection (c) of section 4a-100 and such other relevant information as the Commissioner of Administrative Services prescribes. Any bid submitted without a copy of the prequalification certificate and an update bid statement shall be invalid and considered non-responsible.

#### **1.3 Academic Schedule**

- 1.3.1 It is important to the University, in order to maintain the integrity of its ongoing academic activities, that its rules and regulations and the requirements of the Contract Documents, regarding noise control, traffic control etc. and other matters which may affect its operations be strictly adhered to, and that its academic schedule be maintained. Therefore, all Bidders shall familiarize themselves with and comply with the academic schedule of the University, and its regulations regarding noise, traffic, etc. which are available from Architectural and Engineering Services. No noise generating work shall be allowed during exam periods where the noise will impact classroom functions. Examples of noise generating work include, but are not limited to, sawing, drilling, and hammering/jackhammering. The Contractor shall keep the

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University Representative informed as to the location of its operations to enable necessary precautions or co-ordination to be implemented.

1.4 Non-Discrimination and Affirmative Action Provisions

1.4.1 Non-discrimination. References in this section to "Contract" shall mean the execution of AIA 101 or Purchase Order Contract; and references to "Contractor" shall mean the person or entity who will be solely responsible for execution of the work.

(a) The following subsections are set forth here as required by section 4a-60 of the Connecticut General Statutes:

(1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, mental retardation, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the state of Connecticut. The Contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, mental retardation, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Contractor that such disability prevents performance of the work involved; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the commission; (3) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the commission advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor agrees to comply with each provision of this section and sections 46a-68e and 46a-68f and with each regulation or relevant order issued by said commission pursuant to sections 46a-56, 46a-68e and 46a-68f; (5) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor as relate to the provisions of this section and section 46a-56.

(b) If the Contract is a public works contract, the Contractor agrees and warrants that he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works project.

(c) "Minority business enterprise" means any small contractor or supplier of materials fifty-one per cent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) Who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise and (3) who are members of a minority, as such term is defined in subsection (a) of section 32-9n; and "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations. "Good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements.

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- (d) Determination of the Contractor's good faith efforts shall include but shall not be limited to the following factors: The Contractor's employment and subcontracting policies, patterns and practices; affirmative advertising, recruitment and training; technical assistance activities and such other reasonable activities or efforts as the commission may prescribe that are designed to ensure the participation of minority business enterprises in public works projects.
- (e) The Contractor shall develop and maintain adequate documentation, in a manner prescribed by the commission, of its good faith efforts.
- (f) The Contractor shall include the provisions of sections (a) and (b) above in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the state and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with section 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the commission, the Contractor may request the state of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the state and the state may so enter.
- (g) The following subsections are set forth here as required by section 4a-60a of the Connecticut General Statutes:
  - (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of sexual orientation, in any manner prohibited by the laws of the United States or of the state of Connecticut, and that employees are treated when employed without regard to their sexual orientation; (2) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the Commission on Human Rights and Opportunities advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (3) the Contractor agrees to comply with each provision of this section and with each regulation or relevant order issued by said commission pursuant to section 46a-56; and (4) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor which relate to the provisions of this section and section 46a-56.
- (h) The Contractor shall include the provisions of section (g) above in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the state and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with section 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the commission, the Contractor may request the state of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the state and the state may so enter.

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- (i) For the purposes of this entire Non-Discrimination section, "Contract" or "contract" includes any extension or modification of the Contract or contract, "Contractor" or "contractor" includes any successors or assigns of the Contractor or contractor, "marital status" means being single, married as recognized by the state of Connecticut, widowed, separated or divorced, and "mental disability" means one or more mental disorders, as defined in the most recent edition of the American Psychiatric Association's "Diagnostic and Statistical Manual of Mental Disorders", or a record of or regarding a person as having one or more such disorders. For the purposes of this section, "Contract" does not include a contract where each contractor is (1) a political subdivision of the state, including, but not limited to, a municipality, (2) a quasi-public agency, as defined in Conn. Gen. Stat. Section 1-120, (3) any other state, including but not limited to any federally recognized Indian tribal governments, as defined in Conn. Gen. Stat. Section 1-267, (4) the federal government, (5) a foreign government, or (6) an agency of a subdivision, agency, state or government described in the immediately preceding enumerated items (1), (2), (3), (4) or (5).

1.5 Union Labor

- 1.5.1 Attention is called to the fact that there may be construction work now being carried on at the site at which this construction is contemplated being done by UNION LABOR. This fact must be kept in mind by all Bidders submitting proposals for this work.

1.6 Labor Market Area

- 1.6.1 All Bidders shall have read Sections 31-52 and 31-52a of the Connecticut General Statutes, as amended. These references relate to the preference of State citizens, the preference of residents of the labor market area in which the work under the Contract is to be done and the penalties for violations.

1.7 Wage Rates

- 1.7.1 If this project involves new construction of a building or other structure or improvement, and the total cost of all Work to be performed by Contractors and Subcontractors is \$400,000.00 or more, or if the project involves remodeling, refurbishing, rehabilitation, alteration or repair of a building or other structure or improvement, and such total cost is \$100,000.00 or more, then:

- .1 The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund as defined in Subsection (h) of Section 31-53 of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such project is being constructed. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each payday.

- 1.7.2 The State of Connecticut Labor Department Wage Rate Schedule, when required by the University, shall be provided with these documents or will be issued as part of the bid documents or by Bid Clarification/Addendum hereto and is deemed to reflect such customary

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or prevailing wages for this project, and is hereby incorporated and made a part of the Contract Documents.

- 1.7.3 Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes, Section 31-53 as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages".
- 1.7.4 Wage Rates will be posted each July 1<sup>st</sup> on the Department of Labor Website: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us). Such prevailing wage adjustment will not be considered a matter for an annual contract amendment.
- 1.7.5 Wage rates shall be paid pursuant to Section 31-53 and 31-54 of the Connecticut General Statutes, and any regulations issued hereunder.
- 1.7.6 **Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions.** (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268. (b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance.

**ARTICLE 2 BIDDERS' REPRESENTATIONS**

- 2.1 The amount of each Bid shall be deemed to include the entire cost and expense of every item of labor, material and overhead necessary to complete the work bid upon, as specified, in full detail ready for use. The risk of all such costs and expenses shall be deemed assumed by the successful Bidder. The University shall assign a University Representative to work with the successful Contractor as a liaison.
- 2.2 In performing its obligations under this Contract, the Contractor agrees to comply with all applicable states, laws, ordinances, regulations, codes, rules or orders of, or issued by, any governmental body having jurisdiction over the work, location of the work or contract.

**ARTICLE 3 BIDDING DOCUMENTS**

**3.1 Bid Clarifications, Addenda and Interpretations**

- 3.1.1 No interpretations of the meaning of the Drawings, specifications or other Contract Documents will be made orally to any Bidder. Every request for such interpretation must be

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made in writing to the University Office of Capital Project & Contract Administration, and to be given consideration shall be received at the specified date outlined within the invitation to bid and/or adjusted by a bid clarification/addenda.

- 3.1.2 Any and all such interpretations and any supplemental instructions will be in the form of written bid clarification/addenda which, if issued, will be posted on the University's Capital Projects and Contract Administration's Department website; [www.cPCA.uconn.edu](http://www.cPCA.uconn.edu). for all prospective Bidders to access or for those without access to a computer you can obtain them through Joseph Merritt, no later than five (5) days prior to the date fixed for the opening of Bids. Failure of any Bidder to receive any such addendum or interpretation shall not release any Bidder from any obligations under his Bid as submitted, provided notice has been sent to the address furnished by such prospective Bidder for the transmittal of notices, addenda and interpretations. It shall be the Bidder's responsibility to make inquiry as to, and to obtain, the Addenda issued, if any.
- 3.1.3 The number of days shown in 3.1.1 and 3.1.2 may differ from the actual dates given in an Agenda for a Pre-Bid or Pre-Proposal Conference, if so, the number of days listed are, hereby, superseded by the Agenda dates, unless the Bid or Proposal is extended by Addendum, in which case the number of days will again apply unless stated differently in the Addendum.
- 3.1.4 Bidders shall promptly notify the University of any ambiguity, inconsistency or error which they may discover upon examination of these Contract Documents.

**ARTICLE 4 BIDDING PROCEDURES**

**4.1 Requests for Information**

- 4.1.1 Enclosed with this Invitation to Submit Proposals Manual is a Request for Information Form (RFI). All questions/clarifications must be submitted in writing on this form and before the prescribed RFI Deadline. No verbal questions will be answered. All answers to RFI's will be issued in a Bid Clarification/Addenda. Form is at the end of this document.

**4.2 Form of Proposal**

- 4.2.1 Enclosed with this Invitation to Submit Proposals Manual is a Form of Proposal. Bids shall be submitted on a copy of this form. Additional instructions to bidders including information on submission of bids and award and Contract appear on this form. All documents required by these Bid Documents must be returned with your Bid.

**4.3 Bids and Rejection of Bids**

- 4.3.1 General Bids shall be for the complete work as specified and shall include the names of any Subcontractors for the classes of work specified in the Form of Proposal, and for each other class of work for which the University has required a separate section and the dollar amounts of their subcontracts, and the General Contractor shall be selected on the basis of such general Bids. It shall be presumed that the general Bidder intends to perform with its own employees all work in such four classes and such other classes, for which no Subcontractor is named. The general Bidder's qualifications for performing such work shall be subject to review by the University pursuant to the Bid and the Contract Documents.

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- 4.3.2 Bids shall be submitted only on the forms furnished for the specific project, which shall include a completed Form of Proposal containing all information required on the Proposal form, executed with an original signature by a duly authorized officer or representative of the Bidder, and, in the case of a Joint Venture, by duly authorized representatives of each Joint Venture. In no event will Bids or changes in Bids made by telephone, email or fax be considered. Any Form of Proposal omitting or adding items, altering the form, containing conditional or alternative Bids, or without the original signature of the Bidder or its authorized representative, may be rejected.
- 4.3.3 Any Bids received after the scheduled closing time for the receipt of Bids will be returned to the Bidders unopened.
- 4.3.4 Any Bid once deposited with the University of Connecticut may only be withdrawn by letter of request, signed by the depositing Bidder and presented to the Office of Capital Project and Contract Administration, prior to the time of opening of any Bid for the project designated or identified project.
- 4.4 Bid Security
- 4.4.1 Each Bid must be accompanied by a certified check payable to the order of the University of Connecticut, or the Bid may be accompanied by a Bid Bond in the form required by the University, having as surety thereto such surety company or companies acceptable to the University and as are authorized to do business in this State, for an amount not less than 10 per cent of the Bid. All checks submitted by unsuccessful Bidders shall be returned to them after the Contract has been awarded. Bid Security is not required for projects under \$50,000.00.
- 4.4.2 Failure of the successful Bidder to file the required Performance and Labor & Material bonds shall be just cause for the amount of the security deposited with the Bid to be forfeited, any part of the whole of which may be used to make up the difference between the Bid of the defaulting Bidder and the Bid of the next lowest responsible qualified Bidder to whom the work is finally awarded. Failure to execute a contract after award as specified and Bid shall also result in the forfeiture of such Bid Bonds or Certified Check.
- 4.5 Subcontractors
- 4.5.1 The Contractor shall not contract with a person or entity who appears on the State of Connecticut Debarment List, the Federal Davis Bacon Act Debarment List, both of which are available through: <http://ctdol.state.ct.us> or the Federal List of Excluded Parties Listing System available through: <http://epls.arnet.gov>
- 4.5.2 The Bidder shall furnish, with his submitted Bid, as is set forth in the Proposal Form, in the space provided for such purpose, the names and prices of responsible and qualified Subcontractors who are actually to perform the following categories of work under the Base Bid, if their prices exceed \$25,000.00:
- .1 Masonry

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- .2 Electrical
  - .3 Mechanical other than HVAC
  - .4 HVAC
  - .5 Any other class of work identified in the Proposal Form for which a blank space has been provided.
- 4.5.3 The Bidder further agrees that each of the Subcontractors listed on the Proposal Form will be used for the work indicated at the amount stated unless a substitution is permitted by the University.
- 4.5.4 The Bidder further agrees and warrants that he has made good faith efforts to employ minority business enterprises as Subcontractors and suppliers of materials under such contract and shall provide the Commission on Human Rights and Opportunities with such information as is requested by the Commission concerning his employment practices and procedures as they relate to the provisions of the general statutes governing contract requirements.
- 4.5.5 Pursuant to Connecticut General Statutes Section 49-41a, for every contract with the University for the construction, alteration or repair of any building or work, (1) the Contractor, within 30 days after payment to the Contractor by the University, shall be required to pay any amounts due any Subcontractor, whether for labor performed or materials furnished, when the labor or materials have been included in a requisition submitted by the Contractor and paid by the University; (2) the Contractor shall include in each of its subcontracts a provision requiring each Subcontractor to pay any amounts due any of its Subcontractors, whether for labor performed or materials furnished, within 30 days after each Subcontractor receives a payment from the Contractor which encompasses labor or materials furnished by such Subcontractor.
- 4.5.6 Within five days after being notified of the award of a general Contract by the University, or, in the case of an approval of a substitute Subcontractor by the University, within five days after being notified of such approval, the general Bidder shall present to each listed or substitute Subcontractor:
- .1 A subcontract in the form set forth in Section 4b-96 of the Connecticut General Statutes and must be executed with all of your named subcontractors in your form of proposal.
  - .2 A notice of the time limit under this section for executing a subcontract. If a listed Subcontractor fails within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general Bidder selected as a General Contractor, to perform his agreement to execute a subcontract in the form hereinafter set forth with such general Bidder, contingent upon the execution of the general Contract, the General Contractor shall select another Subcontractor, with the approval of the University. When seeking approval for a substitute Subcontractor, the general Bidder shall provide the University with all documents showing (a) the general Bidder's proper presentation of a subcontract to the listed Subcontractor and, (b) communications to or from such Subcontractor after such presentation. The University shall adjust the Contract Price to reflect the difference between the amount of the price of the new Subcontractor and the amount of the price of the listed Subcontractor, if the

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new Subcontractor's price is lower and may adjust such Contract Price, if the new Subcontractor's price is higher. The general Bidder shall, with respect to each listed Subcontractor or approved substitute Subcontractor, file with the University a copy of each executed subcontract within ten days, Saturdays, Sundays and legal holidays excluded, of presentation of a subcontract to such Subcontractor.

- .3 In the event of any conflict or inconsistency between the University of Connecticut's Subcontract form and the Contractor's standard Subcontract form, the provisions of the University of Connecticut's Subcontract form shall prevail. Any standard Subcontract form used will be attached as a supplement to the University of Connecticut's Subcontract form.

**4.6 COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES CONTRACT COMPLIANCE REGULATIONS:**

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes. According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4) Women . . . (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians . . ." An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations. The awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:(a) the bidder's success in implementing an affirmative action plan;(b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the Administrative Regulations of Connecticut State Agencies, inclusive;(c) the bidder's promise to develop and implement a successful affirmative action plan;(d) the bidder's submission of employment statistics contained in the "Employment Information Form", indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and(e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.

- 4.6.1 The following BIDDER CONTRACT COMPLIANCE MONITORING REPORT must be completed in full, signed, and submitted with the bid for this contract. The contract awarding agency and the Commission on Human Rights and Opportunities will use the information contained

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thereon to determine the bidders compliance to Sections 4a-60 and 4a-60a CONN. GEN. STAT., and Sections 46a-68j-23 of the Regulations of Connecticut State Agencies regarding equal employment opportunity, and the bidders \_\_good faith efforts to include minority business enterprises as subcontractors and suppliers for the work of the contract.

1) Definition of Small Contractor:

Section 4a-60g CONN. GEN. STAT. defines a small contractor as a company that has been doing business under the same management and control and has maintained its principal place of business in Connecticut for a one year period immediately prior to its application for certification under this section, had gross revenues not exceeding ten million dollars in the most recently completed fiscal year, and at least fifty-one percent of the ownership of which is held by a person or persons who are active in the daily affairs of the company, and have the power to direct the management and policies of the company, except that a nonprofit corporation shall be construed to be a small contractor if such nonprofit corporation meets the requirements of subparagraphs (A) and (B) of subdivision 4a-60g CONN. GEN. STAT.

2) Description of Job Categories (as used in Part IV Bidder Employment Information)

**MANAGEMENT:** Managers plan, organize, direct, and control the major functions of an organization through subordinates who are at the managerial or supervisory level. They make policy decisions and set objectives for the company or departments. They are not usually directly involved in production or providing services. Examples include top executives, public relations managers, managers of operations specialties (such as financial, human resources, or purchasing managers), and construction and engineering managers.

**BUSINESS AND FINANCIAL OPERATIONS:** These occupations include managers and professionals who work with the financial aspects of the business. These occupations include accountants and auditors, purchasing agents, management analysts, labor relations specialists, and budget, credit, and financial analysts.

**COMPUTER SPECIALISTS:** Professionals responsible for the computer operations within a company are grouped in this category. Examples of job titles in this category include computer programmers, software engineers, database administrators, computer scientists, systems analysts, and computer support specialists

**ARCHITECTURE AND ENGINEERING:** Occupations related to architecture, surveying, engineering, and drafting are included in this category. Some of the job titles in this category include electrical and electronic engineers, surveyors, architects, drafters, mechanical engineers, materials engineers, mapping technicians, and civil engineers.

**OFFICE AND ADMINISTRATIVE SUPPORT:** All clerical-type work is included in this category. These jobs involve the preparing, transcribing, and preserving of written communications and records; collecting accounts; gathering and distributing information; operating office machines and electronic data processing equipment; and distributing mail. Job titles listed in this category include telephone operators, payroll clerks, bill and account collectors, customer service representatives, files clerks, dispatchers, shipping clerks, secretaries and administrative assistants, computer operators, mail clerks, and stock clerks.

**BUILDING AND GROUNDS CLEANING AND MAINTENANCE:**

This category includes occupations involving landscaping, housekeeping, and janitorial services. Job titles found in this category include supervisors of landscaping or housekeeping, janitors, maids, grounds maintenance workers, and pest control workers.

**CONSTRUCTION AND EXTRACTION:** This category includes construction trades and related occupations. Job titles found in this category include boilermakers, masons (all types),

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carpenters, construction laborers, electricians, plumbers (and related trades), roofers, sheet metal workers, elevator installers, hazardous materials removal workers, paperhangers, and painters. Paving, surfacing, and tamping equipment operators; drywall and ceiling tile installers; and carpet, floor and tile installers and finishers are also included in this category.

First line supervisors, foremen, and helpers in these trades are also grouped in this category..  
**INSTALLATION, MAINTENANCE AND REPAIR:** Occupations involving the installation, maintenance, and repair of equipment are included in this group. Examples of job titles found here are heating, ac, and refrigeration mechanics and installers; telecommunication line installers and repairers; heavy vehicle and mobile equipment service technicians and mechanics; small engine mechanics; security and fire alarm systems installers; electric/electronic repair, industrial, utility and transportation equipment; millwrights; riggers; and manufactured building and mobile home installers. First line supervisors, foremen, and helpers for these jobs are also included in the category.

**MATERIAL MOVING WORKERS:** The job titles included in this group are Crane and tower operators; dredge, excavating, and lading machine operators; hoist and winch operators; industrial truck and tractor operators; cleaners of vehicles and equipment; laborers and freight, stock, and material movers, hand; machine feeders and offbearers; packers and packagers, hand; pumping station operators; refuse and recyclable material collectors; and miscellaneous material moving workers.

3) Definition of Racial and Ethnic Terms (as used in Part IV Bidder Employment Information):  
White (not of Hispanic Origin)- All persons having origins in any of the original peoples of Europe, North Africa, or the Middle East.

Black (not of Hispanic Origin)- All persons having origins in any of the Black racial groups of Africa.

Hispanic- All persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

Asian or Pacific Islander- All persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This area includes China, India, Japan, Korea, the Philippine Islands, and Samoa.

American Indian or Alaskan Native- All persons having origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition

**ARTICLE 5      CONSIDERATION OF BIDS**

5.1 Every general bid which is conditional or obscure, or which contains any addition not called for shall be invalid; and the University shall reject every such general Bid. The University shall be authorized to waive minor irregularities, which it considers in its best interest, provided the reasons for any such waiver are stated in writing by the University and made a part of the contract file. No such general Bid shall be rejected because of the failure to submit prices for, or information relating to, any item or items for which no specific space is provided in the general Proposal Form furnished by the University, but this sentence shall not be applicable to any failure to furnish prices or information required by Articles 4.2.1 and 4.4.1 above to be furnished in the form provided by the University. The University also reserves the right to reject any and all bids and again advertise for bids, or to otherwise proceed as permitted under Connecticut General Statutes 10a-109a through 10a-109y.

5.2 General Bids shall be publicly opened and read by the University forthwith. The University may require in the Proposal Form that the General Contractor agree to perform a stated, minimum percentage of

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work with his own forces. The University may also require the General Contractor to set aside a portion of the contract for Subcontractors who are eligible for set aside contracts. The University shall not permit substitution of a Subcontractor for one named in accordance with the provisions of these Instructions or substitution of a Subcontractor for any designated subtrade work bid to be performed by the General Contractor's own forces, except for good cause. The term "good cause" includes but is not limited to a Subcontractor's or, where appropriate, a General Contractor's: (1) Death or physical disability, if the listed Subcontractor is an individual; (2) dissolution, if a corporation or partnership; (3) bankruptcy; (4) inability to furnish any performance and payment bond shown on the Proposal Form; (5) inability to obtain, or loss of, a license necessary for the performance of a particular category of work; (6) failure or inability to comply with a requirement of law applicable to Contractors, Subcontractors, on construction, alteration, or repair projects; (7) failure to perform his agreement to execute a subcontract under Connecticut General Statutes Section 4b-96.

- 5.3 The general Bid Price shall be the price set forth in the space provided on the general Proposal Form. No general Bid shall be rejected (1) because of error in setting forth the name of a Subcontractor as long as the Subcontractors designated are clearly identifiable, or (2) because the Drawings and specifications do not accompany the Bid or are not submitted with the Bid. **FAILURE TO CORRECTLY STATE A SUBCONTRACTOR'S PRICE MAY BE CAUSE FOR REJECTION OF THE GENERAL BIDDER'S BID.**
- 5.4 Any General Contractor who violates any provision of Connecticut General Statutes Section 4b-95 may be disqualified from bidding on other contracts that are subject to the provisions of Chapter 60 of the General Statutes for a period not to exceed twenty-four months, commencing from the date on which the violation is discovered, for each violation.
- 5.5 The University reserves the right to accept or reject any or all Bids within 90 calendar days of the Bid opening, and the Bidder agrees that it may not modify, withdraw, or cancel its Bid and that its Bid Price will be firm for this 90 day period. This 90 day period may be extended by mutual agreement between the University and the Bidder.
- 5.6 The project will be awarded to the responsible qualified Bidder submitting the lowest Bid in compliance with the Bid requirements and within the budget, subject to the provisions of Connecticut General Statutes 10a-109a through 10a-109y.
- 5.7 The University reserves the right to elect to implement some, all or none of the Alternates and/or Options set forth in the Proposal forms, as may be in the best interest of the University. The low Bid shall be determined by taking the Base Price set forth in the Proposal form as selected by the University, plus the Alternates and/or Options selected by the University.
- 5.8 The Bidder agrees that if selected as General Contractor, he shall, within ten (10) days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the University, execute a contract in accordance with the terms of the general Bid.

**ARTICLE 6 POST- BID INFORMATION**

**6.1 Affirmative Action**

- 6.1.1 Pursuant to Connecticut General Statutes Section 46a-68d, if this project is estimated to cost more than \$50,000.00 then: In the event that the Bidder's Bid is accepted, after acceptance, but before a contract is awarded, the successful Bidder shall file and have approved by the

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Commission on Human Rights and Opportunities an Affirmative Action Plan. The Commission may provide for conditional acceptance of an Affirmative Action Plan provided written assurances are given by the Contractor that it will amend its plan to conform to affirmative action requirements. The University shall withhold 2% of the total Contract Price per month from any payment made to such Contractor until such time as the Contractor has developed an Affirmative Action Plan, and received the approval of the Commission. Notwithstanding the provisions of Connecticut General Statutes Section 46a-68d, a Contractor subject to the provisions of that Section may file a plan in advance of or at the same time as its Bid.

6.1.2 The University shall not enter into a contract with any Bidder or prospective Contractor unless the Bidder or prospective Contractor has satisfactorily complied with the provisions of Sections 4a-60, 32-9e, 46a-56 and 46a-68c to 46a-68f, inclusive of the Connecticut General Statutes, or submits a program for compliance acceptable to the Commission on Human Rights and Opportunities.

6.1.3 The Contractor shall designate an "Equal Opportunity Contract Compliance Officer" for the project. The Contractor designee, in addition to any other duties assigned by the Contractor, shall have the following responsibilities for the implementation of the Contractor Affirmative Action Plan (AAP) that is required for the project pursuant to Connecticut General Statutes Section's 46a-68c and 46a-68d.

- .1 Maintain a project EEO file to include all records, correspondence and other documentation related to the project AAP.
- .2 Communicate to and inform all project Contractors and Subcontractors, regardless of tier, and labor referral organizations (if applicable) about project equal opportunity and AAP expectations and performance requirements.
- .3 Compile all on-site Contractor MONTHLY EMPLOYMENT UTILIZATION REPORTS (form CHRO cc-257) and submit a cumulative report for the project each month to report on contractor compliance to project AAP hiring goals. The cumulative report shall be submitted to the contract awarding agency and to the Commission on Human Rights and Opportunities by the 15th day following the end of each calendar month during the pendency of the on-site construction work of the project.
- .4 Attach a copy of your transmittal letter to CHRO as a document to be submitted with your invoice.
- .5 Compile and submit a QUARTERLY SMALL CONTRACTOR AND MINORITY BUSINESS ENTERPRISE PAYMENT STATUS REPORT (form CHRO cc-258) to report on the participation of such Contractors identified to participate on the project. The report shall be submitted to the contract awarding agency and to the Commission on Human Rights and Opportunities by the 15th day following the end of each calendar quarter during the pendency of the on-site construction work of the project.
- .6 Attach a copy of your transmittal letter to CHRO as a document to be submitted with your invoice.

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- .7 Participate in project job meetings to inform project Contractors about project equal opportunity and AAP performance.
- .8 Coordinate "External Communication" section (employment outreach) of contractor AAP for all employment opportunities resultant during the course of the project from all project Contractors and maintain documentation of all contacts and responses.

**6.2 Tax Identification**

6.2.1 The Contractor shall furnish to the Owner, at the time of execution of the Contract, the following information

- .1 The identity and addresses of all subcontractors performing work on the project.
- .2 The Connecticut tax registration numbers of the Contractor and all subcontractors.
- .3 The Federal Social Security account numbers, or Federal Employer Identification numbers, or both, if applicable, for the Contractor and all subcontractors.

6.2.2 The aforementioned information shall be continuously updated by the Contractor to reflect any additions or changes to the previously identified subcontractors. Any final additions or changes to this information shall be submitted to the Owner with the Contractor's application for final payment.

**ARTICLE 7 PERFORMANCE AND PAYMENT BONDS AND CERTIFICATE OF COMPLIANCE.**

**7.1 Performance Bond**

7.1.1 Prior to execution of the Contract, the successful Bidder shall substitute for the check or Bid Bond accompanying his Bid, an executed University of Connecticut Performance Bond, in the amount of 100 per cent of the Contract Price, conditioned upon the faithful performance of the Contract. See Form of Proposal for the appropriate form to be executed.

**7.2 Labor and Material Payment Bond**

7.2.1 Prior to execution of the Contract, the Bidder shall submit a University of Connecticut Labor and Material Payment Bond in the sum of not less than 100 per cent of the Contract Price, containing the condition that the Contractor will promptly pay for all material furnished and labor, supplied or performed in the prosecution of the work whether or not said material or labor is involved and/or becomes a component part of the structure or structures to be erected. Such additional bond shall be held for the use of each party who, as Subcontractor or otherwise, shall have furnished material or supplies or shall have performed labor in the prosecution of the work as herein provided and who has not been paid therefore. Such additional bond shall provide specifically that any person may bring suit thereon in the name of the person suing, prosecute the same to the final judgment and have execution thereon for such sum or sums as may be justly due. The State shall not be liable to furnish counsel nor for the payment of any costs or expenses of any such suit. This bond is to be furnished pursuant to Section 49-41 of the General Statutes of Connecticut, and claims thereon shall be subject to the provisions of Connecticut General Statutes Section 49-42. Such forms will be provided with the Letter of Intent to award to be executed.

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7.3 Nonresident Contractor Certificate of Compliance

- 7.3.1 Prior to execution of the Contract, the Bidder shall submit proof that ensures they and all subcontractors being contracted to perform work under the awarded bid; are State of Connecticut resident contractors. Such proof shall be in a form on the awarding Contractor's letter head signed by the owner or principle of the company having authority to ensure that all agreements entered into under this contract are in-state resident contractors. Should the awarding Contractor and/or subcontractors who will perform work under this contract, are nonresident of the State of Connecticut, the awarding Contractor must provide a Certificate of Compliance from the Department of Revenue Services (DRS) for those nonresident firms who will be under contract. This Certificate of Compliance is pursuant to Statue 12-430 as amended by 2005 Connecticut Public Acts 260, 6; Connecticut Agencies Regulations 12-430 (7)-1.

7.4 General Provisions Regarding Bonds

- 7.4.1 The aforementioned Performance and Payment bonds shall be provided in the forms required by the University, samples of which are appended hereto. If the Contractor is a Joint Venture, all such bonds shall name all joint ventures as principals. The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney. The above bonds shall be required for awards for which the total estimated cost of labor and materials under the Contract is at least \$100,000.00. The above bonds shall be acceptable to the University and, as a minimum, issued through a bonding company licensed to transact such business in the State of Connecticut and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the "Treasury Department Circular 570."

**ARTICLE 8 AFFIDAVITS/ETHICS AFFIRMATIONS**

- 8.1 Affidavits/Ethics Affirmations to be completed in accordance with the instructions provided on the OPM website for each Affidavits/Ethics Affirmations.

**Form 5. Consulting Agreement Affidavit (for contract values >\$50,000)**

**Form 6. Affirmation of Receipt of State Ethics Laws Summary (for contract values >\$500,000)**

- 8.2 With regard to a State contract as defined in P.A. 07-1 having a value in a calendar year of \$50,000 or more or a combination of series of such agreements or contracts having a value of \$100,000 or more, the authorized signatory to this submission in response to the State's solicitation expressly state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice. See attached **SEEC Form 11.**

Obtain OPM has posted the approved Forms on the OPM Web site -  
<http://www.opm.state.ct.us/secr/forms/ContractAffidavitRequirements.htm>

**ARTICLE 9 CONTRACT**

- 9.1 A draft of the contract has been provided with the bid documents. The University reserves the right to modify the contract or wave any informality as it deems to be in the best interest of the University. By submitting a bid the Contractor accepts the contract and any modifications that the University deems necessary to it without exception. Exceptions to the contract submitted by the Contractor at any time will not be considered.

**REQUEST FOR INFORMATION FORM**

*PLEASE TYPE -OR- PRINT / SEE INVITATION AND ADDENDA'S FOR RFI DEADLINE*

**TO:** The University of Connecticut.  
**Fax (860) 486-1953**

**FROM:** \_\_\_\_\_  
(Name of Bidding Firm)

**ATTN:** Walt Dalia

**Contact Name:** \_\_\_\_\_

**RFI Deadline:** See Invitation/Bid Clarifications Phone # : \_\_\_\_\_ Fax # : \_\_\_\_\_

**Specification Section:** \_\_\_\_\_ **Drawing No. / Drawing Date:** \_\_\_\_\_

**QUESTION (Please be specific):** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**RESPONSE :** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

**NOTE:** All questions must be submitted in writing before the prescribed RFI Deadline. No verbal questions will be answered. All questions must be submitted in writing on this RFI Form. All answers to RFI's will be issued in a Bidder's Clarification.



**STATE OF CONNECTICUT**  
**STATE ELECTIONS ENFORCEMENT COMMISSION**  
20 Trinity Street Hartford, Connecticut 06106—1628

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**SEEC FORM 11**

**NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN**

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined below):

**Campaign Contribution and Solicitation Ban**

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract or state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

**Duty to Inform**

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

**Penalties for Violations**

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties—\$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of \$2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or \$5000 in fines, or both.

**Contract Consequences**

Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such

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violation.

The State will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, [www.ct.gov/seec](http://www.ct.gov/seec). Click on the link to "State Contractor Contribution Ban."

Definitions:

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract*, (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

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“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

**END OF INSTRUCTION TO BIDDERS**

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**FORM OF PROPOSAL**

**Proposal Submission Checklist**

The following documents and information shall be submitted and included as your bid proposal. All documents must be submitted in a sealed envelope reflecting the submitting firm's name and address; addressed to CPCA attention to the appropriate purchasing agent, clearly stating the project name and project number. All required documents are to be included and executed in their original condition as issued.

- Ethics Forms 5 (if contract value is > \$50,000) and 6 (if contract value is > \$500,000).
- Bid Bond
- Fully executed Form of Proposal
- Copies of prequalification certificate and an updated statement as prescribed by Commissioner of Administrative Services for the State of Connecticut.
- How did you learn about this Project?
  - Hartford Courant
  - Waterbury Republican
  - Norwich Bulletin
  - DAS
  - CPCA Website
  - Other \_\_\_\_\_

**Contractors Certification**

**By submitting a bid proposal, the bidder is attesting to the review, reading, understanding, and acceptance of the information and requirements of the project contained within the bid documents without exception. By submitting a bid proposal, the Bidder represents that they have examined the site, and accept the conditions under which the work will be performed and we have read, evaluated, understand, and accepted all the Contract Documents, including those documents provided for on the Disk, and their content in their entirety and have included all provisions necessary to accomplish all work according to the information and requirements prescribed therein without exception.**

SUBMITTED BY:

Firm: \_\_\_\_\_

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

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

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

Print Name: \_\_\_\_\_

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

Telephone: \_\_\_\_\_

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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University of Connecticut  
Walt Dalia, Purchasing Agent II  
Capital Project & Contract Administration  
3 North Hillside Road, Unit 6047  
Storrs, Connecticut 06269-6047

Dear Mr. Dalia:

1. In accordance with Connecticut General Statutes Sections 10a-109a through 10a-109y and pursuant to, and in compliance with your Invitation to Bid, the Notice and Instructions to Bidders, the Form of Contract, including the conditions thereto, the form of required bond, I (we) propose to furnish the labor and/or materials installed as required for the project named and numbered on the FORM OF PROPOSAL of this proposal to the extent of the Proposal submitted herein, furnishing all necessary equipment, machinery, tools, labor and other means of construction, and all materials specified in the manner and at the time prescribed strictly in accordance with the provisions of the Contract including specifications and/or drawings together with all addenda issued and received prior to the scheduled closing time for the receipt of the bids, and in conformity with requirements of the University of Connecticut and any laws or departmental regulations of the State of Connecticut or of the United States which may affect the same, for and in consideration of the price(s) stated on the said FORM OF PROPOSAL, hereof.
2. The Lump Sum Base Bid by me (us) on the FORM OF PROPOSAL includes all work indicated on the drawings and/or described in the specifications (including the furnishing and installing of all required materials, labor, equipment and allowances where applicable), except:
  - A. Work covered by Alternates as may be listed on the FORM OF PROPOSAL.
  - B. Contingent work covered by Unit Prices as may be listed on the FORM OF PROPOSAL.
  - C. Work covered by Options as may be listed on the FORM OF PROPOSAL.
3. This proposal is submitted subject to and in compliance with the foregoing and following conditions and/or information.
  - A. AWARD: All proposals shall be subject to the provisions and requirements of the Bid Documents and for purpose of award, consideration shall be given only to proposals submitted by qualified and responsible bidders.
  - B. COMMENCEMENT AND COMPLETION OF WORK: Contractor shall commence and complete the work in accordance with the requirements of the Contract Documents.
  - C. If the Contractor fails to complete the work within the time required by the Contract Documents, the University shall have the right to assess liquidated damages as provided in Paragraph 9.11 of the General Conditions.
  - D. CONTRACTORS INSURANCE REQUIRED:
    1. The limits of liability and coverages shall be those set forth in Article 11 of the General Conditions included with this bid package (or as previously executed with the on-call trade contract).
  - E. REQUIRED PERCENTAGES OF WORK AND SET-ASIDES

FORM OF PROPOSAL

- .1 If awarded this contract, we (I) as the General Contractor on this Project shall be required to perform not less than 10% of the completed dollar value of the Work with its own forces.
- .2 We (I) as the General Contractor on this project shall award not less than 25% of the total Contract Price to subcontractors who are certified and eligible to participate under the State of Connecticut Small Business Set Aside Program, of which 6.25% (of the total Contract) must be awarded to Women Owned or Minority Businesses. This requirement must be met even if the General Contractor is certified and eligible to participate in the Small Business Set Aside Program. To facilitate compliance with this requirement for set aside subcontractors, submit a list of certified set aside contractors to be used on this project along with the dollar amounts to be paid to each, on the form provided, and a copy of their current certification must be attached. This information will be considered as part of your bid proposal and failure to comply with any portion of this requirement, including but not limited to failure to list or meet the necessary dollar amount of percentage of the bid price will be cause to reject your bid.

F. NONDISCRIMINATION & LABOR RECRUITMENT:

We (I) agree that the Contract awarded for this project shall be subject to the Executive Orders No. Three and Seventeen, promulgated June 16, 1971 and February 15, 1973 respectively and to the Guidelines and Rules of the State Labor Department implementing Executive Order No. Three and further agree to submit reports of Compliance Staffing on Labor Department Form E.O.3-1, when and as requested.

G. FEDERAL & STATE WAGE DETERMINATIONS AND PRICING CONSIDERATION:

- .1 Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes, Section 31-53 as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages".
- .2 In determining bid price, consideration should be given to Section 31-53 of the General Statutes of Connecticut as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages". Such prevailing wage adjustment will not be considered a basis for an annual contract adjustment.
- .3 The State of Connecticut Labor Department Wage Schedule where required, shall be provided with these documents, typically with the Bidders' Convenience Package, or will be incorporated in the Contract Documents as an Addendum. At the time of bidding, the bidder agrees to accept the current prevailing wage scale, as well as any annual adjustment to the prevailing wage scale, as provided by the Connecticut Department of Labor. Wage Rates will be posted each July 1st on the Department of Labor website: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us) . Such prevailing wage adjustment will not be considered a basis for an annual contract amendment.

H. CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY & NON-SEGREGATED FACILITIES:

We (I) acknowledge that we (I) and our subcontractors are obligated to fill out the forms provided by the University of Connecticut Office of Capital Project and Contract Administration and to agree to certify to the compliance of non-segregated facilities.

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

I. NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OR CAMPAIGN CONTRIBUTION AND SOLICITATION BAN.

With regard to a State contract as defined in P.A. 07-1 having a value in a contract year of \$50,000 or more or a combination or series of such agreements or contracts having a value of \$100,000 or more, the authorized signatory to this submission in response to the State's solicitation expressly acknowledges receipt of the State Elections Enforcement Commission's notice advertising prospective principals of the contents of the notice. See Attachment SEEC Form 11.

4. ACCOMPANYING THIS PROPOSAL IS:

A. A CERTIFIED CHECK drawn to the order of the University of Connecticut in the amount of 10% of the Bid, i.e.:

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

and drawn on the \_\_\_\_\_  
(STATE BANK & TRUST COMPANY)

\_\_\_\_\_ located at \_\_\_\_\_  
(A NATIONAL BANKING ASSOCIATION) (CITY & STATE)

which is understood shall be cashed and the proceeds thereof used so far as may be necessary to reimburse the State of Connecticut for losses and damages arising by virtue of my (our) failure to file the required Bonds and execute the required contract in this proposal as accepted by the University of Connecticut.

**OR;**

B. A BID BOND having as surety thereto a Surety Company for Companies authorized to transact business in the State of Connecticut and made out in the penal sum of 10% of the bid, (Bids \$50,000 and greater) i.e.:

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

If the bidder is a joint venture, the Bid Bond shall specifically identify and include each joint venturer as a principal.

C. If the bidder is a joint venture, a copy of the executed Joint Venture Agreement shall be submitted along with the bid materials.

5. We (I), the undersigned, hereby declare that I am (we are) the only person(s) interested in the proposal and that it is without any connection with any other person making any bid for the same work. No person acting for, or employed by, the State of Connecticut is directly interested in this proposal, or in any contract which may be made under it, or in expected profits to arise therefrom. This proposal is made without directly or indirectly influencing or attempting to influence any other person or corporation to bid or refrain from bidding or to influence the amount of the bid of any other person or corporation. This proposal is made in good faith without collusion or connection with any other person bidding for the same work and this proposal is made with distinct reference and relation to the plans and specifications prepared for this Contract. I (We) further declare that in regard to the conditions affecting the work to be done and the labor

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#901696**

**FORM OF PROPOSAL**

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and materials needed, this proposal is based solely on my (our) investigation and research and not in reliance upon any representations of any employee, officer or agent of the State.

6. Each class of work set forth in a separate Section of the Specifications and designated as a subtrade in Item 2A of the proposal pages shall be the matter of a subcontract made in accordance with the procedures set forth in the Bid and Contract Documents.
7. The undersigned agrees that, if selected as General Contractor, he shall, within ten (10) days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the University of Connecticut, execute a contract in accordance with the terms of this general bid.
8. The undersigned agrees and warrants that he has made good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials under such contract and shall provide the Commission on Human Rights and Opportunities with such information as is requested by the Commission concerning his employment practices and procedures as they relate to the provisions of the Connecticut General Statutes governing contract requirements.
9. The undersigned acknowledges that should their submitted Form of Proposal fail to have included a copy of your firms prequalification certificate and an updated statement accompany their bid submission, that their bid will be invalid and considered non-responsive. Per CGS 4b-91 amended.

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**FORM OF PROPOSAL**

**A. STANDARD BID BOND:**

**NOW ALL MEN BY THESE PRESENTS,**

That we, \_\_\_\_\_ hereinafter called the principal, of \_\_\_\_\_, as principal, and \_\_\_\_\_, hereinafter called the Surety, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact a surety business in the State of Connecticut, as Surety, are held and firmly bound unto the State of Connecticut, as obligee, in the penal sum of ten (10) percent of the amount of the bid set forth in a proposal hereinafter mentioned, \_\_\_\_\_, in lawful money of the United States of America, for the payment of which sum, well and truly to be made to the Obligee, the Principal and the Surety bind, themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH,**

That, whereas the Principal has submitted or is about to submit a proposal the other obligee related to a contract for the Project Referenced above.

**NOW, THEREFORE,** if the said contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter in the said contract in writing with the State of Connecticut and give the required bonds, with surety acceptable to the Obligee, or if the Principal shall fail to do so, pay to Obligee the damages which the Obligee may suffer by reason of such failure not exceeding the penal sum of this bond, then this obligation shall be void, otherwise to remain in full force and effect.

SIGNED, SEALED AND DATED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

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**FORM OF PROPOSAL**

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**B.** The undersigned proposes to furnish all labor and material required for:

**CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**University of Connecticut  
Storrs, CT**

in accordance with the accompanying Drawings and Specifications prepared by:

**RMF Engineering**

The Contract Price specified below subject to additions and deductions according to the terms of the Contract Documents.

**C. BID CLARIFICATIONS:**

The undersigned acknowledges receipt of the following Bid Clarifications issued during the bidding period and has included all changes therein in the above base bid amount.

Clarifications/Addenda # \_\_\_\_\_, Dated \_\_\_\_\_

**D. PROPOSED BASE CONTRACT PRICE:**

Having carefully examined the Bid Documents for the above reference project, and having visited the project site and examined all conditions affecting the work, the undersigned, upon written notice of award of contract, agrees to provide all labor, supervision, materials, tools, construction equipment, services, safety, insurance, bonds, and to pay all applicable taxes, and other costs necessary or required to complete the Work of this Bid in full accordance with all Bid Documents and within the required timeframe as indicated by the proposed schedule for the Lump Sum Bid of:

\_\_\_\_\_ **US Dollars**

**(\$ \_\_\_\_\_) (which incorporates all allowances as may be listed in the plans and specifications)**

**(Show the amount in both words and figures. In case of discrepancy, amount shown in words will govern.)**

The University reserves the right to elect to implement some, all or none of the Alternates and/or Options set forth in the Proposal forms, as may be in the best interest of the University. The low Bid shall be determined by taking the Base Price set forth in the Proposal form as selected by the University, plus the Alternates and/or Options selected by the University.

**E. SCHEDULE OF ALTERNATES: (Not Used)**

Provide Alternate Prices which reflect the work of the bid package under which this bid proposal was submitted and shall remain ***valid for the life of the project*** and include **all costs** for a complete installation. All pricing is inclusive of all costs of wages, applicable taxes, benefits, and applicable insurance. The Prices herein shall remain valid for the life of the project and include all costs for a complete installation. Alternate prices are good for both adds and deducts.

**END OF ALTERNATES**

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**F. SCHEDULE OF UNIT PRICES: (Not Used)**

All rates are inclusive of all costs of wages, applicable taxes, benefits, applicable insurance. The rates provided will be negotiated and included as part of the contract and of your subcontracts. The Unit Prices herein shall remain valid for the life of the project and include all costs for a complete installation. Unit prices are good for both adds and deducts.

<u>Unit Price</u>	<u>Description</u>	<u>Unit of Measurement</u>	<u>Add/Deduct Rate</u>

End of Unit Prices

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FORM OF PROPOSAL

G. SCHEDULE OF LABOR RATES:

The following are hourly wage rates for all tradesmen associated with this project for performing extra work. These rates are fully loaded (including benefits, applicable taxes, and worker compensation insurance) and are in accordance with the prevailing wages of the trade having jurisdiction in areas where the work is performed. The wage rates shall be valid for the life of the project. ***NOTE: Further, no mark-up shall be allowed on the premium time portion of the wage rate. At the request of the University, the Contractor will submit labor rate summary sheets, which justify all submitted labor rates. All rates are subject to thorough analysis and subject to reduction if deemed inaccurate by The University of Connecticut.***

TRADE: \_\_\_\_\_

Attachments: Y / N

Submit one sheet for each Labor Trade (Division) used on project. Copy as needed.

<u>Foreman</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Journeyman</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Apprentice</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Laborer</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

End Labor Rates

**UNIVERSITY OF CONNECTICUT  
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**H. SCHEDULE OF VALUES:**

The undersigned agrees that the Schedule of Values submitted with this Bid is a true representation of the distribution of the costs of this project and equals the Stipulated Sum shown above. The Schedule of Values is an integral part of this proposal. Please indicate N/A for those divisions of work not applicable. The costs provided below include the complete cost for furnishing and installing of materials, labor, and equipment required to provide the complete scope of work for each specified division (includes the costs of applicable taxes, insurance, bonds, overhead, profit, small tools, travel, parking, supervision, etc.). The "TOTAL" price must equal your total lump sum bid proposal.

Division 1, General Conditions/Requirements	\$ _____
Division 2, Existing Conditions	\$ _____
Division 3, Concrete	\$ _____
Division 4, Masonry	\$ _____
Division 5, Metals	\$ _____
Division 6, Wood, Plastics and Composites	\$ _____
Division 7, Thermal and Moisture Protection	\$ _____
Division 8, Openings	\$ _____
Division 9, Finishes	\$ _____
Division 10, Specialties	\$ _____
Division 11, Equipment	\$ _____
Division 12, Furnishings	\$ _____
Division 13, Special Construction	\$ _____
Division 14, Conveying Equipment	\$ _____
Division 15 through 20 Not Used	
Division 21 Fire Suppression	\$ _____
Division 22 Plumbing	\$ _____
Division 23 Heating, Ventilating & Air Conditioning	\$ _____
Division 24 Not Used	
Division 25 Integrated Automation	\$ _____
Division 26 Electrical	\$ _____
Division 27 Communications	\$ _____
Division 28 Electronic Safety & Security	\$ _____
Division 29 and 30 Not Used	
Division 31 Earthwork	\$ _____
Division 32 Exterior Improvements	\$ _____
Insurance	\$ _____
Bonds	\$ _____
Allowances (where applicable)	\$ _____
<b>TOTAL</b>	<b>\$ _____</b>

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**I. The subdivision of Work in the proposed Contract Price is as follows:**

**ITEM 1 WORK BY GENERAL CONTRACTOR:**

For all work other than that to be done by subcontractors included in Item 2A and Item 2B.

\$ \_\_\_\_\_ **(ITEM 1)**

**Note:** In accordance with paragraph 3.E.1 this amount, together with work by the general contractor as listed in Item 2A below, must be at least 10% of the total bid price.

**ITEM 2A WORK BY SUBCONTRACTORS NAMED:**

Subcontractors and prices for the following trades must be listed (if such prices exceed \$25,000). However, the general bidder may list himself together with his price if he customarily performs any of the trades specified. If the general contractor requires a performance and/or labor & material payment bond then the general contractor must indicate below which of the subcontractors are subject to this requirement. The amount (%) shall not exceed the subcontractor's price listed below.

DESCRIPTION	NAME OF SUBCONTRACTOR	DOLLAR AMOUNT	LABOR & MATERIAL BOND	PERFORMANCE BOND
MASONRY				
ELECTRICAL				
MECHANICAL WITHOUT HVAC				
HVAC				

**A copy of the executed agreement between the successful bidder and the named subcontractors above must be presented to the Office of CPCA at time of contract signing. The contract may not be executed until copies of executed agreements are received by CPCA.**

**ITEM 2B WORK BY SUBCONTRACTORS NOT NAMED:**

\$ \_\_\_\_\_  
**(INCLUDES ALL SUBCONTRACT WORK NOT LISTED IN ITEM 2A)**

The undersigned agrees that each of the subcontractors listed on this FORM OF PROPOSAL will be used for the work indicated at the amount stated, unless a substitution is permitted by the University.

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**FORM OF PROPOSAL**

**J. SET-ASIDE CONTRACTOR SCHEDULE**

In accordance with Section 5.2 of our Notice and Instructions to Bidders, it is a requirement to list below the names of each currently certified set aside contractor anticipated to be used for this project, along with the dollar amount to be paid each contractor.

The responsibility for listing a qualified and certified set aside contractor, Women Owned Businesses or Minority Businesses, rests solely with the proposer and not the State. **We acknowledge that listing a subcontractor who does not qualify shall be considered the same as not listing one at all and the proposal may be considered non-responsive and subject to rejection.**

<u>Name</u>	<u>Address</u>	<u>Amount</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

The amount is NOT LESS THAN 25% of the proposed base contract price as stated on the Form of Proposal, Section D.

**CERTIFICATE OF ELIGIBILITY HAS BEEN OBTAINED THROUGH THE FOLLOWING WEBSITE;  
<https://www.biznet.ct.gov/SupplierDiversity/SDSearch.aspx>  
FOR EACH OF THE NAMED CONTRACTORS AND IS BEING SUBMITTED WITH THIS FORM.**

The Undersigned agrees that each of the subcontractors listed on the proposal form will be used for the work indicated at the amount stated, unless a substitution is permitted by the awarding authority.

\_\_\_\_\_  
Authorized Signature Title

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

**K. BIDDER CONTRACT COMPLIANCE MONITORING REPORT**

**PART I - Bidder Information**

Company Name Street Address City & State Chief Executive	Bidder Federal Employer Identification Number _____ Or Social Security Number _____
Major Business Activity (brief description)	Bidder Identification (response optional/definitions in Instruction to Bidders page 18)  -Bidder is a small contractor. Yes__ No__  -Bidder is a minority business enterprise Yes__ No__ (If yes, check ownership category)  Black__ Hispanic__ Asian American__ American Indian/Alaskan Native ____ Iberian Peninsula__ Individual(s) with a Physical Disability__ Female__
Bidder Parent Company(If any)	-Bidder is certified as above by State of CT Yes__ No__ -
Other Locations in Ct. (If any)	DAS                      Certification                      Number _____

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**PART II - Bidder Nondiscrimination Policies and Procedures**

<p>1. Does your company have a written Affirmative Action/Equal Employment Opportunity statement posted on company bulletin boards? Yes__ No__</p>	<p>7. Do all of your company contracts and purchase orders contain non-discrimination statements as required by Sections 4a-60 &amp; 4a-60a Conn. Gen. Stat.? Yes__ No__</p>
<p>2. Does your company have the state-mandated sexual harassment prevention in the workplace policy posted on company bulletin boards? Yes__ No__</p>	<p>8. Do you, upon request, provide reasonable accommodation to employees, or applicants for employment, who have physical or mental disability? Yes__ No__</p>
<p>3. Do you notify all recruitment sources in writing of your company's Affirmative Action/Equal Employment Opportunity employment policy? Yes__ No__</p>	<p>9. Does your company have a mandatory retirement age for all employees? Yes__ No__</p>
<p>4. Do your company advertisements contain a written statement that you are an Affirmative Action/Equal Opportunity Employer? Yes__ No__</p>	<p>10. If your company has 50 or more employees, have you provided at least two (2) hours of sexual harassment training to all of your supervisors? Yes__ No__ NA__</p>
<p>5. Do you notify the Ct. State Employment Service of all employment openings with your company? Yes__ No__</p>	<p>11. If your company has apprenticeship programs, do they meet the Affirmative Action/Equal Employment Opportunity requirements of the apprenticeship standards of the Ct. Dept. of Labor? Yes__ No__ NA__</p>
<p>6. Does your company have a collective bargaining agreement with workers? Yes__ No__</p> <p>6a. If yes, do the collective bargaining agreements contain non-discrimination clauses covering all workers? Yes__ No__</p> <p>6b. Have you notified each union in writing of your commitments under the nondiscrimination requirements of contracts with the state of Ct? Yes__ No__</p>	<p>12. Does your company have a written affirmative action Plan? If no, please explain. Yes__ No__</p>
	<p>13. Is there a person in your company who is responsible for equal employment opportunity? Yes__ No__ If yes, give name and phone number. _____ _____</p>

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**Part III - Bidder Subcontracting Practices**

1. Will the work of this contract include subcontractors or suppliers? Yes\_\_ No\_\_  
 1a. If yes, please list all subcontractors and suppliers and report if they are a small contractor and/or a minority business enterprise as defined on page 1 / use additional sheet if necessary)  
 1b. Will the work of this contract require additional subcontractors or suppliers other than those identified in 1a? Yes\_\_ No\_\_

**Part IV – Bidder Employment Information**

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

JOB CATEGORY	OVERALL TOTALS	WHITE (not of Hispanic origin)		BLACK (not of Hispanic origin)		HISPANIC		ASIAN or PACIFIC ISLANDER		AMERICAN INDIAN or ALASKAN NATIVE	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Management											
Business & Financial Ops											
Computer Specialists											
Architecture/Engineering											
Office & Admin Support											
Bldg/ Grounds Cleaning/Maintenance											
Construction & Extraction											
Installation, Maintenance & Repair											
Material Moving Workers											
TOTALS ABOVE											
Total One Year Ago											
FORMAL ON THE JOB TRAINEES		(ENTER FIGURES FOR THE SAME CATEGORIES AS ARE SHOWN ABOVE)									
Apprentices											
Trainees											

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**PART V - Bidder Hiring and Recruitment Practices**

1. Which of the following recruitment sources are used by you? (check yes or not and report percent used)				2. Check (x) any of the below listed requirements that you use as a hiring qualification		3. Describe below any other practices or actions that you take which show that you hire, train, and promote employees without discrimination?
SOURCE	YES	NO	% of applicants provided by source	(x)		
State Employment Service					Work Experience	
Private Employment Agencies					Ability To Speak Or Write English	
Schools And Colleges					Written Tests	
Newspaper Advertisements					High School Diploma	
Walk Ins					College Degree	
Present Employees					Union Membership	
Labor Organizations					Personal Recommendations	
Minority/Community Organizations					Height Or Weight	
Others Please Identify					Car Ownership	
					Arrest Record	
					Wage Garnishments	

Certification (Read this form and check your statements on it CAREFULLY before signing).

I certify that the statements made by me on this BIDDER CONTRACT COMPLIANCE MONITORING REPORT are complete and true to the best of my knowledge and belief, and are made in good faith. I understand that if I knowingly make any misstatements of facts, I am subject to be declared in non-compliance with Section 4a-60, 4a-60a, and related sections of the CONN. GEN. SAT.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date Signed)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Telephone)

# CODE OF CONDUCT FOR UNIVERSITY OF CONNECTICUT VENDORS

The University of Connecticut (“UConn”) has a longstanding commitment to the protection and advancement of socially responsible practices that reflect respect for fundamental human rights and the dignity of all people. UConn strives to promote basic human rights and appropriate labor standards for all people throughout its supply chain. Promoting these values in concrete practice is the central charge of the President’s Committee on Corporate Social Responsibility (<http://csr.uconn.edu/>).

UConn is also committed to building a safe, healthy and sustainable environment through the conservation of natural resources, increasing its use of environmentally responsible products, materials and services (including renewable resources), and preventing pollution and minimizing waste through reduction, reuse and recycling. UConn is proactive about purchasing products that have these environmental attributes or meet recognized environmental standards, when practicable, and buying from entities committed to the support of campus sustainability goals. The University seeks to partner and contract with vendors that demonstrate a similar commitment to these values. Selected vendors may be required to provide a comprehensive summary report of their corporate social and environmental practices.

## **Principal Expectations**

The principal expectations set forth below reflect the minimal standards UConn’s vendors are required to meet.

**Nondiscrimination.** It is expected that vendors will not discriminate in hiring, employment, salary, benefits, advancement, discipline, termination or retirement on the basis of race, color, religion, gender, nationality, ethnicity, alienage, age, disability or marital status, and will comply with all federal nondiscrimination laws and state nondiscrimination laws<sup>1</sup>, including Chapter 814c of the Connecticut General Statutes (Human Rights and Opportunities), as applicable, and further will provide equal employment opportunity irrespective of such characteristics, including complying, if applicable, with Federal Executive Order 1124b, and the Rehabilitation Act of 1973.

**Freedom of Association and Collective Bargaining.** It is expected that vendors will respect their employees’ rights of free association and collective bargaining, including, if applicable, complying with the National Labor Relations Act, and, if applicable, Chapters 561 and 562 of the Connecticut General Statutes (Labor Relations Act, Labor Disputes) and Chapters 67 and 68 of the Connecticut General Statutes (State Personnel Act, Collective Bargaining for State Employees).

**Labor Standard Regarding Wages, Hours, Leaves and Child Labor.** It is expected that vendors will respect their employees’ rights regarding minimum and prevailing wages, payment of wages, maximum hours and overtime, legally mandated family, child birth and medical leaves, and return to work thereafter, and limitations on child labor, including, if applicable, the

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<sup>1</sup> Wherever this code refers to compliance with federal or state laws, that term includes compliance with any regulations duly promulgated pursuant to such laws.

rights set forth in the Federal Fair Labor Standards Act, the Federal Family and Medical Leave Act, the Federal Davis-Bacon Act and Chapters 557 and 558 of the Connecticut General Statutes (Employment Regulation, Wages).

**Health and Safety.** It is expected that vendors will provide safe and healthful working and training environments in order to prevent accidents and injury to health, including reproductive health, arising out of or related to or occurring during the course of the work vendors perform or resulting from the operation of vendors' facilities. Accordingly, it is expected that vendors and their subcontractors will perform work pursuant to UConn contracts in compliance with, as applicable, the Federal Occupational Safety and Health Act and Chapter 571 of the Connecticut General Statutes (Occupational Safety and Health Act).

**Forced Labor.** It is expected that vendors will not use or purchase supplies or materials that are produced using any illegal form of forced labor.

**Harassment or Abuse.** It is expected that vendors will treat all employees with dignity and respect, and that no employee will be subjected to any physical, sexual, psychological or verbal abuse or harassment. It is further expected that vendors will not use or tolerate the use of any form of corporal punishment.

**Environmental Compliance.** It is expected that vendors will comply with all applicable federal and state environmental laws and Executive Orders, including but not limited to Titles 22a and 25 of the Connecticut General Statutes (Environmental Protection and Water Resources protection) and Executive Order 14 (concerning safe cleaning products and services). UConn expects vendors will employ environmentally responsible practices in the provision of their products and services.

### **Preferential Standards**

The preferential standards set forth below reflect UConn's core values. UConn will seek to uphold these values by considering them as relevant factors in selecting vendors.

**Living Wages.** UConn recognizes and affirms that reasonable living wages are vital to ensuring that the essential needs of employees and their families can be met, and that such needs include basic food, shelter, clothing, health care, education and transportation. UConn seeks to do business with vendors that provide living wages so as to meet these basic needs, and further recognizes that compensation may need to be periodically adjusted to ensure maintenance of such living wages. Vendors are encouraged to demonstrate that they pay such living wages.

**International Human Rights.** For UConn, respect for human rights is a core value. UConn seeks to do business with vendors who do not contribute to or benefit from systemic violations of recognized international human rights and labor standards, as exemplified by the Universal Declaration of Human Rights.

**Foreign Law.** UConn encourages vendors and vendors' suppliers operating under foreign law to comply with those foreign laws that address the subject matters of this code, provided such foreign laws are consistent with this code. Vendors and their suppliers operating under foreign law are similarly encouraged to comply with the provisions of this code to the extent they can do so without violating the foreign law(s) they operate under.

**Environmental Sustainability.** UConn will prefer products and services that conserve resources, save energy and use safer chemicals, such as recycled, recyclable, reusable, energy efficient, carbon-neutral, organic, biodegradable or plant-based, in addition to products that are durable and easily repairable, and that meet relevant certification standards above and beyond those required by law. While UConn is not legally bound to comply with Connecticut General Statutes 4a-67a through 4a-67h concerning environmental sustainability standards in purchasing, it will nevertheless consider vendors' ability to meet those standards in rendering its purchasing decisions. Vendors are encouraged to demonstrate their commitment to environmental sustainability.

**Compliance Procedures**

Anyone who believes a vendor doing business with UConn has not complied or is not complying with this code may report such concerns to UConn's Office of Audit, Compliance and Ethics (OACE) at 1-888-685-2637 or <https://www.compliance-helpline.com>.

OACE has the authority to investigate such matters, and if warranted, recommend remedial action to the UConn administration.

Please review the material listed and per the signature of the authorized Company Official, all Expectations, Standards, and Procedures listed above will be in compliance in regards to this Contract.

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Name of Company

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Signature of Authorized Company Official

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Date

## Connecticut Economic Impact Form

This form is intended to gather general Connecticut economic impact information from prospective suppliers. This form shall be updated with each solicitation. This form is for informational gathering purposes only and will not be used in the evaluation of a prospective supplier's qualifications.

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

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

Location (City, State) of Principal Place of Business: \_\_\_\_\_

Date Registered to do Business in Connecticut: \_\_\_\_\_

Number of Connecticut Locations: \_\_\_\_\_

Number of Connecticut Employees: \_\_\_\_\_

Annual Payroll Paid to Connecticut State Residents: \_\_\_\_\_

Annual Taxes, Licenses, Fees Paid to Connecticut (this may be payroll, franchise, service taxes, etc.): \_\_\_\_\_

Annual Rent Paid within Connecticut or value of Real Property: \_\_\_\_\_

Annual Utilities Paid within Connecticut: \_\_\_\_\_

Amount paid to Major partners or suppliers in Connecticut: \_\_\_\_\_

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**L. PROPOSER'S QUALIFICATION/RESPONSIBILITY STATEMENT**

The Proposer shall have already completed and submitted the Questionnaire and other submission required by the University in its Invitation to Pre-Qualify, regarding the Proposer's qualifications. If changed circumstances arising since the initial submission, or other facts have occurred which would result in a material change to any of the Proposer's initial responses or submissions, the Proposer shall provide any such supplementary, or revised information at this time, along with its Proposal.

1. State, identify any such changed circumstances or other facts and provide any such supplementary or revised information as described above, identifying specifically, by number and content, each prior question, response to the Questionnaire, or information changed, supplemented or revised. (Attach a separate sheet if necessary)
2. State "NONE" if there are no changes to be made. \_\_\_\_\_

Please note that if the end date of the time period covered by the information submitted during your pre-qualification is three or more months old, please provide current financial documentation demonstrating that your present financial position has remained the same, or showing and identifying any changes in any way, in relation to the audited financial statement you submitted with your pre-qualified application on this proposal.

Dated at	this	day of	20
Name of Organization:			
Signature:			
Print Name:			
Title:			
<b><u>Notary Statement:</u></b>			
Mr./Mrs./Ms.		being duly sworn deposes and says that he/she	
is the	of	and that the	
(Position or Title)		(Firm Name)	
answers to the foregoing questions and all statements therein contained are true and correct.			
Subscribed and sworn to before me this	day of	20	
Notary Public:			
My Commission Expires:	20		

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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M. ETHICS FORMS - A duly authorized representative of the company must sign these forms

- √ **These forms must be notarized and clearly show notary seal or acknowledged by a Commissioner of the Superior Court.**
  
- √ ALL REQUIRED forms, **must be completed, signed and returned** by the bidder/proposer as part of the bid/proposal/RFQ response package.
  
- √ Failure to submit ALL REQUIRED forms constitutes grounds for rejection of your bid/proposal/RFQ.
  
- √ If it is determined by the University of Connecticut and/or State of Connecticut that **any information requested was not referenced and submitted** with this bid/proposal/RFQ/LOI, and then such determination **will be just cause for disqualification of the bid/proposal/RFQ.**

OPM Ethics Form 5  
Rev. 10-01-11



STATE OF CONNECTICUT  
CONSULTING AGREEMENT AFFIDAVIT

*Affidavit to accompany a bid or proposal for the purchase of goods and services with a value of \$50,000 or more in a calendar or fiscal year, pursuant to Connecticut General Statutes §§ 4a-81(a) and 4a-81(b). For sole source or no bid contracts the form is submitted at time of contract execution.*

**INSTRUCTIONS:**

**If the bidder or vendor has entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete all sections of the form. If the bidder or contractor has entered into more than one such consulting agreement, use a separate form for each agreement. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public. **If the bidder or contractor has not entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete only the shaded section of the form. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public.

Submit completed form to the awarding State agency with bid or proposal. For a sole source award, submit completed form to the awarding State agency at the time of contract execution.

This affidavit must be amended if there is any change in the information contained in the most recently filed affidavit not later than (i) thirty days after the effective date of any such change or (ii) upon the submittal of any new bid or proposal, whichever is earlier.

**AFFIDAVIT:** [Number of Affidavits Sworn and Subscribed On This Day: \_\_\_\_\_]

I, the undersigned, hereby swear that I am a principal or key personnel of the bidder or contractor awarded a contract, as described in Connecticut General Statutes § 4a-81(b), or that I am the individual awarded such a contract who is authorized to execute such contract. I further swear that I have not entered into any consulting agreement in connection with such contract, **except for the agreement listed below:**

_____		_____
Consultant's Name and Title		Name of Firm (if applicable)
_____	_____	_____
Start Date	End Date	Cost
Description of Services Provided: _____		
_____		
_____		

Is the consultant a former State employee or former public official?  YES  NO

If YES: \_\_\_\_\_  
Name of Former State Agency Termination Date of Employment

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____	_____	_____
Printed Name of Bidder or Contractor	Signature of Principal or Key Personnel	Date
_____		_____
Printed Name (of above)		Awarding State Agency

Sworn and subscribed before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Commissioner of the Superior Court  
or Notary Public

OPM Ethics Form 6  
Rev. 10-01-11



**STATE OF CONNECTICUT**  
**AFFIRMATION OF RECEIPT OF STATE ETHICS LAWS SUMMARY**

*Written or electronic affirmation to accompany a large State construction or procurement contract, having a cost of more than \$500,000, pursuant to Connecticut General Statutes §§ 1-101mm and 1-101qq*

**INSTRUCTIONS:**

Complete all sections of the form. Submit completed form to the awarding State agency or contractor, as directed below.

**CHECK ONE:**

- I am a person seeking a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency with my bid or proposal. [Check this box if the contract will be awarded through a competitive process.]
- I am a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency at the time of contract execution. [Check this box if the contract was a sole source award.]
- I am a subcontractor or consultant of a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the contractor.
- I am a contractor who has already filed an affirmation, but I am updating such affirmation either (i) no later than thirty (30) days after the effective date of any such change or (ii) upon the submittal of any new bid or proposal, whichever is earlier.

**IMPORTANT NOTE:**

Within fifteen (15) days after the request of such agency, institution or quasi-public agency for such affirmation contractors shall submit the affirmations of their subcontractors and consultants to the awarding State agency. Failure to submit such affirmations in a timely manner shall be cause for termination of the large State construction or procurement contract.

**AFFIRMATION:**

I, the undersigned person, contractor, subcontractor, consultant, or the duly authorized representative thereof, affirm (1) receipt of the summary of State ethics laws\* developed by the Office of State Ethics pursuant to Connecticut General Statutes § 1-81b and (2) that key employees of such person, contractor, subcontractor, or consultant have read and understand the summary and agree to comply with its provisions.

\* The summary of State ethics laws is available on the State of Connecticut's Office of State Ethics website.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Firm or Corporation (if applicable)

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

\_\_\_\_\_  
Awarding State Agency



**STATE OF CONNECTICUT**  
**NONDISCRIMINATION CERTIFICATION – Affidavit**  
**By Entity**  
**For Contracts Valued at \$50,000 or More**

*Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson, member, or other corporate officer duly authorized to adopt corporate, company, or partnership policy that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended*

**INSTRUCTIONS:**

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at \$50,000 or more for any year of the contract. Complete all sections of the form. Sign form in the presence of a Commissioner of Superior Court or Notary Public. Submit to the awarding State agency prior to contract execution.

**AFFIDAVIT:**

I, the undersigned, am over the age of eighteen (18) and understand and appreciate the obligations of

an oath. I am \_\_\_\_\_ of \_\_\_\_\_, an entity  
Signatory's Title Name of Entity

duly formed and existing under the laws of \_\_\_\_\_.  
Name of State or Commonwealth

I certify that I am authorized to execute and deliver this affidavit on behalf of

\_\_\_\_\_ and that \_\_\_\_\_  
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

\_\_\_\_\_  
Authorized Signatory

\_\_\_\_\_  
Printed Name

Sworn and subscribed to before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Commissioner of the Superior Court/  
Notary Public

\_\_\_\_\_  
Commission Expiration Date



**STATE OF CONNECTICUT**

Written or electronic PDF copy of the written certification to accompany a large state contract pursuant to P.A. No. 13-162 (Prohibiting State Contracts With Entities Making Certain Investments In Iran)

**Respondent Name:** \_\_\_\_\_

**INSTRUCTIONS:**

- CHECK ONE:**  Initial Certification  
 Amendment or renewal

**A. Who must complete this certification pursuant to P.A. No. 13-162.** Prior to submitting a bid proposal, or, if there was no bid process, prior to executing a contract, for all large state contracts, this certification must be completed by any corporation, general partnership, limited partnership, limited liability partnership, joint venture, nonprofit organization or other business organization **whose principal place of business is located outside of the United States** ("Respondent"). United States subsidiaries of foreign corporations are exempt. For purposes of this Certification, a "foreign corporation" is one that is organized and incorporated outside the United States of America.

**Check applicable box:**

- Respondent's principal place of business is within the United States or Respondent is a United States subsidiary of a foreign corporation. Respondents who check this box **are not required to complete the remainder of the certification**, but must submit this certification with its Invitation to Bid ("ITB"), Request for Proposal ("RFP") or contract package if there was no bid process.
- Respondent's principal place of business is outside the United States and it is not a United States subsidiary of a foreign corporation. **CERTIFICATION required.** Please complete the remainder of the certification and submit it with the ITB or RFP response or contract package if there was no bid process.

**B. Additional definitions.**

- 1) "Large State Contract" has the same meaning as provided in section 4-250 of the Connecticut General Statutes; and
- 2) "State agency" and "quasi-public agency" have the same meanings as provided in section 1-79 of the Connecticut General Statutes.

**C. Certification requirements.**

No state agency or quasi-public agency shall enter into any large state contract, or amend or renew any such contract with any Respondent unless the Respondent has submitted this certification.

Complete all sections of this certification and sign and date it, under oath, in the presence of a Commissioner of the Superior Court, a Notary Public or a person authorized to take an oath in another state.

**CERTIFICATION:**

I, the undersigned, am the official authorized to execute contracts on behalf of the Respondent. I certify that:

Respondent has made no direct investments of twenty million dollars or more in the energy sector of Iran on or after October 1, 2013, as described in Section 202 of the Comprehensive Iran Sanctions, Accountability and Divestment Act of 2010.

Respondent has either made direct investments of twenty million dollars or more in the energy sector of Iran on or after October 1, 2013, as described in Section 202 of the Comprehensive Iran Sanctions, Accountability and Divestment Act of 2010, or Respondent made such an investment prior to October 1, 2013 and has now increased or renewed such an investment on or after said date, or both.

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

\_\_\_\_\_  
**Printed Respondent Name**

\_\_\_\_\_  
**Printed Name of Authorized Official**

\_\_\_\_\_  
**Signature of Authorized Official**

**Subscribed and acknowledged before me this \_\_day of \_\_\_\_\_, 20\_\_.**

\_\_\_\_\_  
**Commissioner of the Superior Court (or Notary Public)**

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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**All pages within the Form of Proposal must be completed, signed by a duly authorized representative of the firm and returned as part of the bid/proposal/RFQ response package. NO FACSIMILE SIGNATURE PERMITTED**

- √ **If the form of proposal is being submitted by a Joint Venture, each Joint Venture shall sign the Proposal, and each Joint Venture agrees to be bound by the terms and conditions thereof.**
- √ **Failure to submit ALL REQUIRED forms constitutes grounds for rejection of your bid/proposal/RFQ.**
- √ **If it is determined by the University of Connecticut and/or State of Connecticut that any information requested but not referenced and submitted with this bid/proposal; such determination will be just cause for disqualification of the bid/proposal.**

(TO BE FILLED IN AND SIGNED BY THE BIDDER)

Signed the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Firm Name: \_\_\_\_\_

Street: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

(TO BE FILLED IN AND SIGNED BY JOINT VENTURE IF APPLICABLE)

Firm Name: \_\_\_\_\_

Street: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

**End of Form of Proposal**

**Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions.** (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2009, the Labor Commissioner shall adopt regulations, in accordance with the provisions of chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1.)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine

## Informational Bulletin

### **THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE**

(applicable to public building contracts entered into *on or after July 1, 2007*, where the total cost of all work to be performed is at least \$100,000)

- (1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);
- (2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;
- (3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least \$100,000;
- (4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;
- (5) The internet website for the federal OSHA Training Institute is [http://www.osha.gov/fso/ote/training/edcenters/fact\\_sheet.html](http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html);
- (6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;
- (7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;
- (8) Proof of completion may be demonstrated through either: (a) the presentation of a *bona fide* student course completion card issued by the federal OSHA Training Institute; *or* (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;
- (9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

- (10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;
- (11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;
- (12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;
- (13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;
- (14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and
- (15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.
- (16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of <http://www.ctdol.state.ct.us/wgwkstnd/wgemenu.htm>; or by telephone at (860)263-6790.

**THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTIMATELY ARISE CONCERNING THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS.**

November 29, 2006

## Notice

### **To All Mason Contractors and Interested Parties Regarding Construction Pursuant to Section 31-53 of the Connecticut General Statutes (Prevailing Wage)**

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

#### **Forklift Operator:**

- **Laborers (Group 4) Mason Tenders** - operates forklift solely to assist a mason to a maximum height of nine feet only.

- **Power Equipment Operator (Group 9)** - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

*Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.*

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

# Statute 31-55a

Last Updated: July 13, 2009

You are here: [DOL Web Site](#) › [Wage and Workplace Standards](#) › [Statute 31-55a](#)

## - Special Notice -

To All State and Political Subdivisions, Their Agents, and Contractors

**Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.**

*Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July first.*

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the **contractor's** responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's Web Site. The annual adjustments will be posted on the Department of Labor Web page: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us). For those without internet access, please contact the division listed below.
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project. All subsequent annual adjustments will be posted on our Web Site for contractor access.

**Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860) 263-6790.**

←-- [Workplace Laws](#)

Published by the Connecticut Department of Labor, Project Management Office

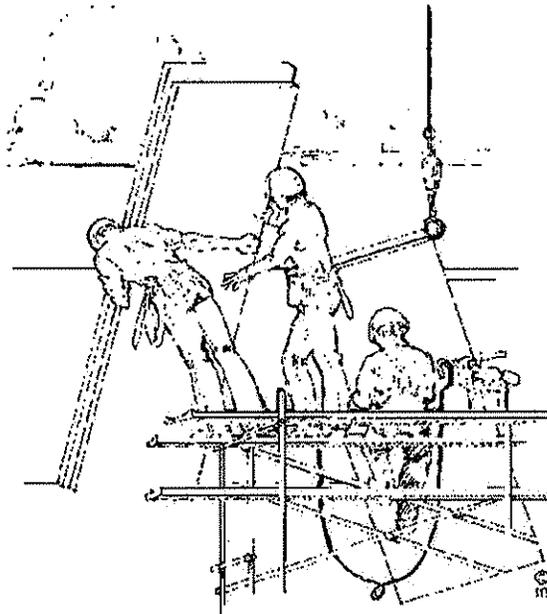
~NOTICE~

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached "Contracting Agency Certification Form" to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

 Inquiries can be directed to (860)263-6543.



# Certified Payroll Form WWS - CPI

Last Updated: July 14, 2009

**You are here:** [DOL Web Site](#) › [Wage and Workplace Standards](#) › Certified Payroll Form WWS - CPI

In accordance with [Connecticut General Statutes, 31-53](#) Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.

**Note:** Once you have downloaded these forms and are ready to print them out, set the print function on your PC to the horizontal print orientation.

**Note2:** Please download both the Payroll Certification for Public Works Projects **and** the Certified Statement of Compliance for a complete package. The Certified Statement of Compliance appears on the same page as the Fringe Benefits Explanation page.

**Announcement: The Certified Payroll Form WWS-CPI can now be completed on-line!**

- [Certified Payroll Form WWS-CPI](#) (PDF, 727KB)
- [Sample Completed Form](#) (PDF, 101KB)

Published by the Connecticut Department of Labor, Project Management Office

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS													
Connecticut Department of Labor Wage and Workplace Standards Division 200 Folly Brook Blvd. Wetherfield, CT 06109						WORKERS COMPENSATION INSURANCE CARRIER							
CONTRACTOR NAME AND ADDRESS						SUBCONTRACTOR NAME & ADDRESS							
PAYROLL NUMBER	Week-Ending Date	PROJECT NAME & ADDRESS					POLICY #	EFFECTIVE DATE:	EXPIRATION DATE:	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS FEDERAL STATE	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
		PERSON/WORKER ADDRESS and SECTION	APPR RATE %	MALE/FEMALE AND RACE*	WORK CLASSIFICATION	DAY AND DATE							
		Trade License Type & Number - OSHA		HOURS WORKED EACH DAY		BASE HOURLY RATE		TOTAL FRINGE BENEFIT PLAN		TOTAL DEDUCTIONS WITH-HOLDING			
		10 Certification Number		S M T W TH F S		CASH		CASH		FICA			
				Total Hours		S-TIME		Base Rate		FEDERAL STATE			
				O-TIME		Cash Fringe		Base Rate		WITH-HOLDING			
				S-TIME		Base Rate		Base Rate		HOLDING			
				O-TIME		Cash Fringe		Base Rate		HOLDING			
				S-TIME		Base Rate		Cash Fringe		HOLDING			
				O-TIME		Cash Fringe		Base Rate		HOLDING			
				S-TIME		Base Rate		Cash Fringe		HOLDING			
				O-TIME		Cash Fringe		Base Rate		HOLDING			
				S-TIME		Base Rate		Cash Fringe		HOLDING			
				O-TIME		Cash Fringe		Base Rate		HOLDING			
				S-TIME		Base Rate		Cash Fringe		HOLDING			
				O-TIME		Cash Fringe		Base Rate		HOLDING			

7/13/2009 \*IF REQUIRED

\*SEE REVERSE SIDE

PAGE NUMBER \_\_\_ OF \_\_\_

OSHA 10 ~ ATTACH CARD TO 1ST CERTIFIED PAYROLL

**\*FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

- 1) Medical or hospital care \_\_\_\_\_
- 2) Pension or retirement \_\_\_\_\_
- 3) Life Insurance \_\_\_\_\_
- 4) Disability \_\_\_\_\_
- 5) Vacation, holiday \_\_\_\_\_
- 6) Other (please specify) \_\_\_\_\_

**CERTIFIED STATEMENT OF COMPLIANCE**

For the week ending date of \_\_\_\_\_,

I, \_\_\_\_\_ of \_\_\_\_\_, (hereafter known as Employer) in my capacity as \_\_\_\_\_ (title) do hereby certify and state:

**Section A:**

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

- a) The records submitted are true and accurate;
- b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;
- c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);
- d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;
- e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and
- f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

\_\_\_\_\_  
(Signature) (Title) Submitted on (Date)

**Section B: Applies to CONNDOT Projects ONLY**

**That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.**

\_\_\_\_\_  
(Signature) (Title) Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

**\*\*\*THIS IS A PUBLIC DOCUMENT\*\*\*  
\*\*\*DO NOT INCLUDE SOCIAL SECURITY NUMBERS\*\*\***



## **Information Bulletin** ***Occupational Classifications***

The Connecticut Department of Labor has the responsibility to properly determine "job classification" on prevailing wage projects covered under C.G.S. Section 31-53.

*♪ Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification.*

**Below are additional clarifications of specific job duties performed for certain classifications:**

### **Asbestos Insulator**

- Handle, install, apply, fabricate, distribute, prepare, alter, repair, or dismantle heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

### **Carpenter**

- Assembly and installation of modular furniture/furniture systems.  
[New] a. Free-standing furniture is not covered. This includes: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two- position information access station, file cabinets, storage cabinets, tables, etc.
- Applies fire stopping materials on fire resistive joint systems only.
- Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings.
- Installation of curtain/window walls only where attached to wood or metal studs.

### **Cleaning Laborer**

- The clean up of any construction debris and the general cleaning, including sweeping, wash down, mopping, wiping of the construction facility, washing, polishing, dusting, etc., prior to the issuance of a certificate of occupancy falls under the *Labor classification*.

### **Delivery Personnel (Revised)**

- If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages are not required. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.
- An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer/tradesman and not a delivery personnel.

### **Electrician**

- Installation or maintenance of telecommunication, LAN wiring or computer equipment.
- Low voltage wiring.

### **Fork Lift Operator**

- Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.
- Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

### **Glaziers**

- Installs light metal sash, head sills, and 2-story aluminum storefronts.
- Installation of aluminum window walls and curtain walls is the 'joint work' of the Glaziers and Ironworkers classification which requires either a blended rate or equal composite workforce.

### **Ironworkers**

- Handling, sorting, and installation of reinforcing steel (rebar).
- Installation of aluminum window walls and curtain walls is the "joint work" of the Glaziers and Ironworkers classification which requires either a blended rate or equal composite workforce. Insulated metal and insulated composite panels are still installed by the Ironworker.
- Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation.

## **Insulator**

- Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings. Past practice using the applicable licensed trades, Plumber, Sheet Metal, Sprinkler Fitter, and Electrician, is not inconsistent with the Insulator classification and would be permitted.

## **Lead Paint Removal**

- Painter Rate
  1. Removal of lead paint from bridges.
  2. Removal of lead paint as preparation of any surface to be repainted.
  3. Where removal is on a Demolition project prior to reconstruction.
- Laborer Rate
  1. Removal of lead paint from any surface NOT to be repainted.
  2. Where removal is on a *TOTAL* Demolition project only.

## **Roofers**

- Preparation of surface, tear-off and/or removal of any type of roofing, and/or clean-up of any areas where a roof is to be relaid.

## **Sheet Metal Worker**

- Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, fascia, louvers, partitions, wall panel siding, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Insulated metal and insulated composite panels are still installed by the Iron Worker. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers.

## Truck Drivers

- Truck Drivers delivering asphalt are covered under prevailing wage while on the site and directly involved in the paving operation.
- Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
- Hauling material off site is not covered provided they are not dumping it at a location outlined above.
- Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

 Any questions regarding the proper classification should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd, Wethersfield, CT 06 109 at (860) 263-6543.

**CONNECTICUT DEPARTMENT OF LABOR**  
**Wage and Workplace Standards Division**

**FOOTNOTES**

Please Note: If the "Benefits" listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the "Benefits" section for the occupation lists only a dollar amount, disregard the information below.

**Bricklayers, Cement Masons, Cement Finishers, Plasters, Stone Masons**  
(Building Construction)  
(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)

- a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

**Bricklayer (Residential- Fairfield County)**

- a. Paid Holiday: If an employee works on Christmas Eve until noon he shall be paid for 8 hours.

**Electricians**

Fairfield County: West of the Five Mile River in Norwalk

- a. \$2.00 per hour not to exceed \$14.00 per day.

**Elevator Constructors: Mechanics**

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.
- b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

### **Glaziers**

- a. Paid Holidays: Labor Day and Christmas Day.

### **Power Equipment Operators**

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

### **Ironworkers**

- a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive workdays prior to Labor Day.

### **Laborers (Tunnel Construction)**

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular workday preceding the holiday or the regular workday following the holiday.

### **Roofers**

- a. Paid Holidays: July 4<sup>th</sup>, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

### **Sprinkler Fitters**

- a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

### **Truck Drivers**

(Heavy and Highway Construction & Building Construction)

- a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

# AIA<sup>®</sup> Document A101<sup>™</sup> – 2007

## ***Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum***

The following document is the AIA A101 – Standard Form of Agreement for On-Call Trade Contractors Between Owner and Contractor as modified by the University of Connecticut.

Modification Date: April 25, 2012

AGREEMENT made as of the      day of      in the year  
*(In words, indicate day, month and year)*

BETWEEN the Owner:

*(Name, address and other information)*

and the Contractor:

*(Name, address and other information)*

for the following Project:

*(Name, location and description)*

The Architect:

*(Name, address and other information)*

The Owner and Contractor agree as follows.

### **ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201<sup>™</sup>–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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User Notes:

(1752131151)

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- 8 MISCELLANEOUS PROVISIONS
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ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents for each individual project shall consist of the Contract for On-Call Trade Contractor Services for \_\_\_\_\_ executed on \_\_\_\_\_; this AIA A101-2007 Agreement, as amended, the AIA A201-2007 Conditions of the Contract (General Conditions, AIA A201 – 2007, as amended); and the Drawings, Specifications, Bid Clarification(s) and/or Addenda, the Project Manual, including, but not limited to, the Invitation to Bid, Notice and Instructions to Bidders, Contractor’s Form of Proposal, as accepted by the University, all Exhibits within the Proposal, State of Connecticut Department of Labor Prevailing Wage Rates, Labor Rates, and Insurance Certificates, Performance and Payment Bonds, as issued for that individual project, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The provisions of the AIA A101-2007, as amended, and of the attached AIA A201-2007, as amended, apply to this individual project, except to the extent specifically modified in the Contract Documents for the individual project. A further partial enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

§2.1 The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. The Contractor shall furnish and install all materials, labor and equipment required to provide \* \* \* \* \* as set forth in the Contract Documents enumerated in Article 9.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The  
*(Paragraphs deleted)*  
Date of Commencement of the Work shall be fixed in the Notice to Proceed issued by the Owner.

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work of this individual project not later than ( ) days from the date of commencement,  
*(Paragraphs deleted)*  
subject to adjustments of this Contract Time as provided in the Contract Documents.

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Liquidated Damages of \_\_\_\_\_ and 00/100 Dollars (\$ \_\_\_\_\_) per calendar day shall be assessed as provided in Paragraph 9.11 of the AIA A201-2007 General Conditions, as amended.

**ARTICLE 4 CONTRACT SUM**

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$ \_\_\_\_\_), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract sum is based upon the following alternates, if any, which are described in the Contract Documents, and are hereby accepted by the Owner. The Contract Sum is the amount set forth in Section 4.1 and includes the amounts for the following alternates, if any, accepted by the Owner.

Alternate prices, which reflect the work of the bid package under which a bid proposal is submitted shall remain valid for the life of the project, unless otherwise noted in the Contract Documents and include all costs for a complete installation. All pricing is inclusive of all costs of wages, applicable taxes, benefits, applicable insurance, overhead and profit. Alternate prices are good for both adds and deducts.

§ 4.3 Unit prices, if any, are as follows:

All rates are inclusive of all costs of wages, applicable taxes, benefits, applicable insurance, overhead and profit. The rates provided will be negotiated and included as part of a subcontract. The Unit Prices herein shall remain valid for the life of the individual project and include all costs for a complete installation. Unit prices are good for both adds and deducts.

Item

Units and Limitations

Price Per Unit (\$0.00)

§ 4.4 Allowances included in the Contract Sum, if any, are as follows:  
(Identify allowance and state exclusions, if any, from the allowance price.)

Item

Price

**ARTICLE 5 PAYMENTS**

**§ 5.1 PROGRESS PAYMENTS**

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 The Owner shall make payments to the Contractor on each Application of Payment within 45 days of the Owner Representative's receipt of a properly submitted, correct and accepted Application, in accordance with the provisions of the AIA A201-2007 General Conditions, Article 9, as amended. The "Owner Representative" shall be as defined in AIA A201-2007 Paragraph 2.1.1.1.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of Ten Percent (10%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™-2007, General Conditions of the Contract for Construction;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of Ten Percent (10%);
- .3 In addition, if the State Commission on Human Rights and Opportunities ("CHRO") authorizes the award or execution of this contract in advance of CHRO's approval of the Affirmative Action Plan required to be submitted by the Contractor pursuant to Connecticut General Statutes Section 46a-68d, the Owner will withhold an additional two percent (2%) of the total contract price per month from any payment made to such Contractor, until such time as the Contractor has received approval from CHRO of the Affirmative Action Plan. Moreover, if CHRO determines through its complaint procedure and the hearing process provided in Connecticut General Statutes Section 46a-56(c) that a contractor or subcontractor is not complying with anti-discrimination statutes or contract provisions required under Connecticut General Statutes Section 4a-60 or 4a-60(a) or the provisions of Connecticut General Statutes Section 46a-68c to 46a-68f, inclusive, and if so ordered by the presiding officer after such hearing and upon a finding of noncompliance, the University shall retain two percent (2%) of the total contract price per month on the contract with the Contractor.
- .4 Subtract the aggregate of previous payments made by the Owner; and
- .5 Subtract amounts, if any, for which the Owner Representative has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201-2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Owner Representative shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and  
*(Section 9.8.5 of AIA Document A201-2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)*
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201-2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

*(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)*

N/A

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

## § 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201-2007, and to satisfy other requirements, if any, which extend beyond final payment; and

init.

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, subject to the provisions of the AIA A201-2007 General Conditions, Article 9, as amended.

#### ARTICLE 6 DISPUTE RESOLUTION

##### § 6.1 INITIAL DECISION MAKER

The Associate Vice President and Executive Director of Architectural and Engineering Services for the Owner and in the case of a project for the University of Connecticut Health Center ("UCHC"), its Associate Vice President for Facilities Development & Operations will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201-2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

*(Paragraphs deleted)*

##### § 6.2 BINDING DISPUTE RESOLUTION

*(Paragraphs deleted)*

NOT USED.

#### ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201-2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201-2007.

#### ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201-2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

##### § 8.2

*(Paragraphs deleted)*

NOT USED.

##### § 8.3

*(Paragraphs deleted)*

NOT USED.

##### § 8.4

*(Paragraphs deleted)*

NOT USED.

*(Paragraph deleted)*

§ 8.5 The Contractor's representative shall not be changed without ten days written notice to the Owner.

##### § 8.6 Other provisions:

The Contractor is hereby specifically cautioned that unless specifically authorized, in writing, by the University's Executive Vice President for Administration and Chief Financial Officer, or in the case of UCHC its Chief Administrative Officer, on a case by case basis, the Contractor shall have no right to use, and shall not use, in any manner, the name of the University of Connecticut, its officials or employees, or the Seal of the University:

- (a) in any advertising, publicity, promotion, nor;
- (b) to express or to imply any endorsement of Contractor's work product or services.

##### § 8.7 ETHICS AND COMPLIANCE

In accordance with the University's compliance program, the University has in place an anonymous ethics and compliance reporting hotline service – 1-888-685-2637. Any person who is aware of unethical practices, fraud, violation of state laws or regulations or other concerns relating to University policies and procedures can report such

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matters anonymously. Such persons may also directly contact the University's compliance office at: Office of Audit, Compliance, and Ethics, 9 Walters Avenue, Unit 5084, Storrs, CT 06269-5084; Phone 860-486-4526; Fax 860-486-4527. As a provider of goods and/or services to the University, you are hereby required to notify your employees, as well as any subcontractors, who are involved in the implementation of this contract, of this reporting mechanism.

#### § 8.8 JOINT VENTURE

§ 8.8.1 If the Contractor is a joint venture, each joint venture partner shall be jointly, severally and individually responsible to the Owner for the performance of any and all obligations of the Contractor encompassed by this contract or as required by applicable law, and each joint venture partner shall be jointly, severally and individually liable to the Owner for any failures to perform such obligations in accordance with the contract or applicable law. In its dealings with the Owner, each joint venture partner shall have full authority to act in behalf of and bind the joint venture and any other joint venture partner. Each joint venture partner shall be considered to be the agent of the joint venture and of any other joint venture partner.

#### ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101-2007, Standard Form of Agreement Between Owner and Contractor, as amended.

§ 9.1.2 The General Conditions are AIA Document A201-2007, General Conditions of the Contract for Construction, as amended and attached hereto.

§ 9.1.3 NOT USED.

*(Table deleted)*

§ 9.1.4 The Specifications are those contained in the Project Manual for this individual project and are as follows:

Table of Contents – attached as Exhibit A.

*(Table deleted)*

§ 9.1.5 The

*(Paragraphs deleted)*

Drawings shall be the List of Drawings – attached as Exhibit B.

*(Table deleted)*

§ 9.1.6 The Bid Clarifications or Addenda, Exhibit C, if any, are as follows:

Number

Date

Pages

Portions of Bid Clarifications or Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, for this individual project forming part of the Contract Documents are enumerated as follows:

The Invitation to Bid dated \_\_\_\_\_

Notice and Instructions to Bidders

Contractor's Proposal Form dated \_\_\_\_\_

Project Manual dated \_\_\_\_\_

Labor Rates attached as Exhibit D

CPM Schedule attached as Exhibit E

Owner's Contractor Environmental, Health & Safety Manual

Payment and Performance Bonds (attached hereto)

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User Notes:

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**ARTICLE 10 INSURANCE AND BONDS**

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201-2007.

This Agreement is entered into as of the day and year first written above and is executed in at least three originals, of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.

\_\_\_\_\_  
*OWNER (Signature)*

Executive VP for Administration & CFO

\_\_\_\_\_  
Duly Authorized: CGS §§ 10a-109d; 10a-109n  
*(Printed name and title)*

Date: \_\_\_\_\_  
*(Paragraphs deleted)*

\_\_\_\_\_  
*CONTRACTOR (Signature)*

\_\_\_\_\_  
*(Printed name and title)*

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

Init.

# AIA<sup>®</sup> Document A201<sup>™</sup> – 2007

## General Conditions of the Contract for Construction

The following document is the AIA A201 – General Conditions of the Contract for Construction as modified by the University of Connecticut and is for any project which is included within the University of Connecticut On-Call Trade Contractor Program.

**Modification Date: September 13, 2012**  
for the following PROJECT:

*(Name and location or address)*

**THE OWNER:**

*(Name and address)*

**THE CONTRACTOR:**

*(Name and address)*

**THE ARCHITECT:**

*(Name and address)*

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**ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

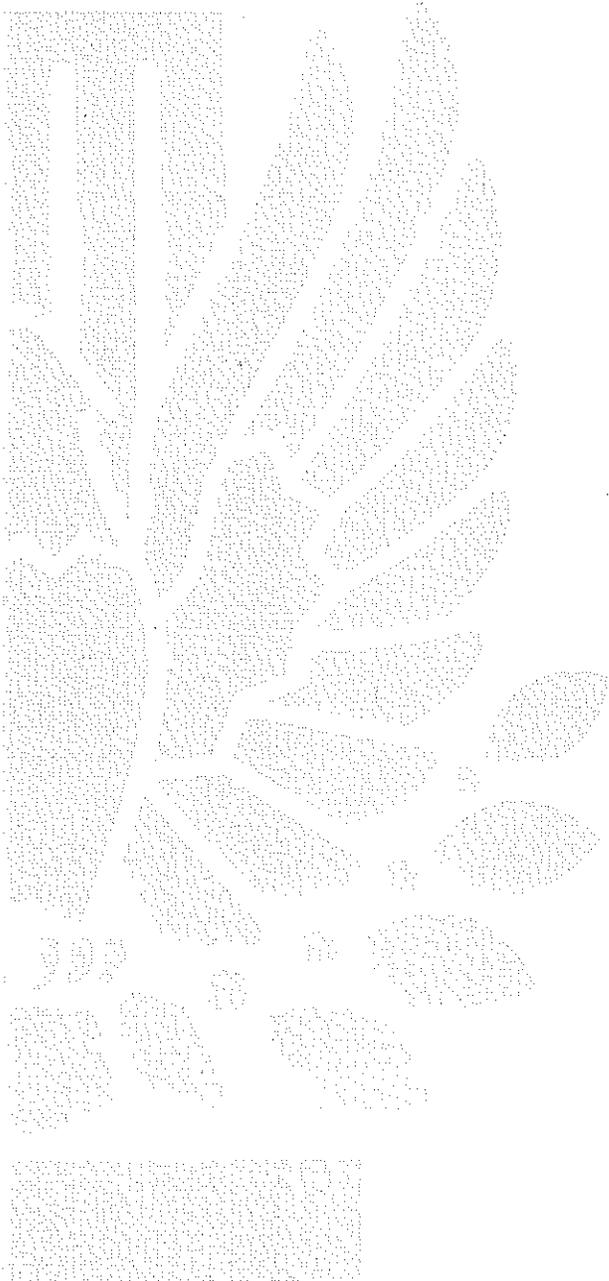
This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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### Work, Definition of

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Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5,  
9.9.1, 9.10.2, 9.10.3, 11.4.1, 13.2, 13.4.2, 15.4.4.2

Written Interpretations

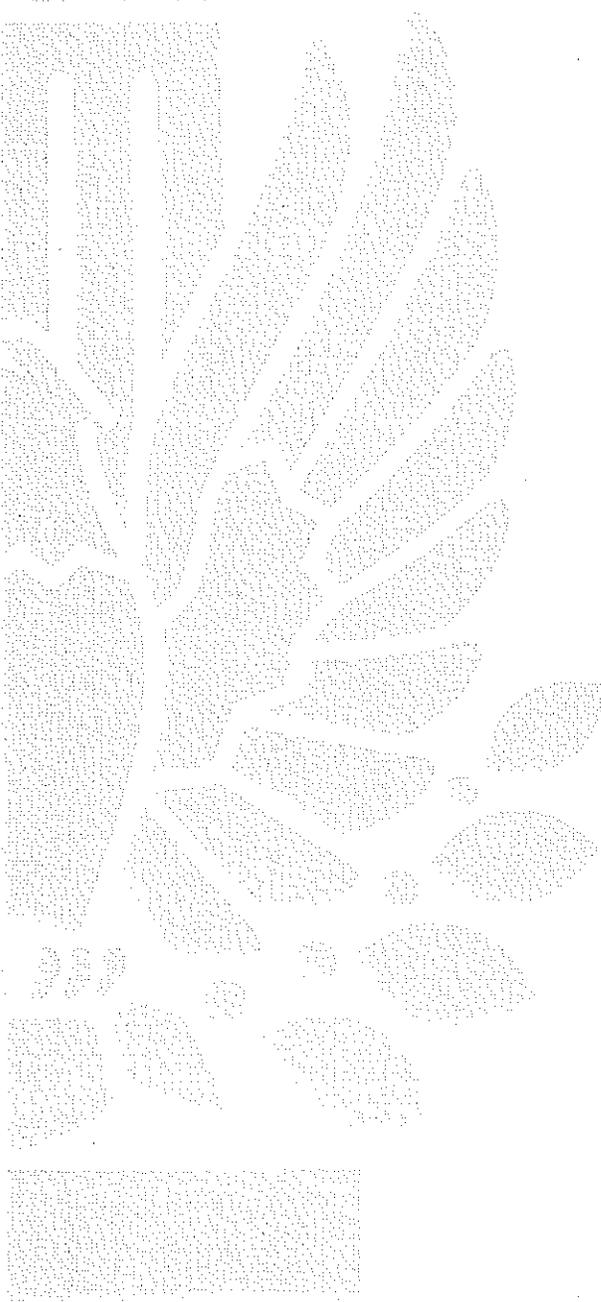
4.2.11, 4.2.12

Written Notice

2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 8.2.2, 9.7,  
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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 BASIC DEFINITIONS

#### § 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents for each individual project consist of the Contract for On-Call Trade Contractor Services for \_\_\_\_\_ executed on \_\_\_\_\_; the AIAA101-207 Agreement, as amended, this AIA A201-2007 Conditions of the Contract (General Conditions, as amended), Drawings, Specifications, Bid Clarifications and/or Addenda as issued for that individual project, the Project Manual, including the Invitation to bid, Notice and Instructions to Bidders, Contractor's Form of Proposal, as accepted by the University, all Exhibits within the Proposal, State of Connecticut Department of Labor prevailing Wage Rates, Labor Rates, and Insurance Certificates, Performance and Payment Bonds, as issued for that individual project, other documents listed in this Contract and Modifications issued after execution of this Contract, all of which form the Contract, and are as fully a part of the Contract as if attached to this Contract or repeated herein. An enumeration of the Contract Documents, other than a Modification, appears in Article 9 of the AIA A101-2007. The provisions of the AIA A101, as amended, and of the AIA A201, as amended, apply to each individual project, except to the extent specifically modified in the Contract Documents for the individual project. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. In the event of any conflict between provisions of the Contract for On-Call Trade Contractor Services for \_\_\_\_\_ and the AIA A101 Agreement, the AIA A201 General Conditions, as modified by the Owner and Division One of the Specifications, issued for the individual project, on the one hand, and provisions of the technical specifications and plans prepared by the Architect, on the other hand, the provisions of the former group of documents shall take precedence.

§ 1.1.1.1 Whenever the words, "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the direction, "requirement", "order", "designation", or "prescription" of the Owner Representative is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean, "approved by", or "acceptable to", or "satisfactory to" the Owner Representative unless otherwise expressly state. The "Owner Representative" shall be as defined in the AIA A201-2007 Section 2.1.1.1.

§ 1.1.1.2 Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the Contract Documents accompanying this Contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place" that is, "furnished and installed".

§ 1.1.1.3 All personal pronouns used in this Contract, whether used in the masculine, feminine, or neuter gender, shall include all other genders; and the singular shall include the plural and vice versa. Title of Articles and Sections are for convenience only, and neither limit or amplify the provisions of this Contract in itself. The use herein of the word "including", when following any general statement, term, or matter, shall not be construed to limit such statement, term, or matter to the specific items or matters set forth immediately following such word or to similar items or matters, whether or not non-limiting language (such words as "without limitation", or "but not limited to", or words of similar import) is used with reference thereto, but rather shall be deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such general statement, term or matter.

#### § 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project, whether on or off the site of the Project, and including all labor, materials, equipment and services provided or to be provided

by subcontractors, sub-subcontractors, material suppliers or any other entity for whom the Contractor is responsible under or pursuant to the Contract Documents.

#### **§ 1.1.4 THE PROJECT**

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

#### **§ 1.1.5 THE DRAWINGS**

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

#### **§ 1.1.6 THE SPECIFICATIONS**

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

*(Paragraphs deleted)*

#### **§ 1.1.7 THE PROJECT MANUAL**

The Project Manual is a volume assembled for the Work, which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

#### **§ 1.1.8 INSTRUMENTS OF SERVICE**

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### **§ 1.1.9 INITIAL DECISION MAKER**

The Initial Decision Maker is the person identified in the AIA A101-2007 Contract Section 6.1 to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Contract under Section 14.2.2.

### **§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

**§ 1.2.1.1** In the event of inconsistencies within or between parts of the Contract Documents or between the Contract documents and applicable standards, codes, and ordinances, the Contractor shall: 1) provide the better quality or greater quantity of work, or 2) comply with the more stringent requirement; either or both in accordance with the Owner Representative's interpretation. The terms and conditions of this Section 1.2.1 however, shall not relieve the Contractor of any of the obligations set forth in Sections 3.2 and 3.7.

**§ 1.2.1.1.1** Before ordering any materials or doing any Work, the Contractor and each Subcontractor shall verify measurements at the project site and shall be responsible for the correctness of such measurements. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the Work.

**§ 1.2.1.1.2** If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for approval by the Architect before making the change.

**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

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§ 1.2.4 In performing its obligations under this contract, the Contractor shall comply with all applicable statutes, laws, ordinances, regulations, codes, rules or orders of, or issued by any governmental body having jurisdiction over the Work, location of the Work, or the Contract.

§ 1.2.5 If any item, material, product or equipment is found to be specified in more than one Division Section or Article of the Specifications, the Contractor shall be responsible for determining which subcontractor or supplier shall provide the item.

§ 1.2.5.1 When applied to materials and equipment, the words "furnish", "install", and "provide" shall mean the following:

The word "provide" shall mean to furnish, pay for, deliver, install, adjust, clean and otherwise make materials and equipment fit for their intended use, as specified in Section 3.5 of the General Conditions.

The word "furnish" shall mean to secure, pay for, deliver to site, unload, uncrate and store materials.

The word "install" shall mean to place in position, incorporate in the work, adjust, clean, make fit for use, and perform all services specified in General Conditions Section 3.5 except those included under the definition of the word "furnish" above.

The phrase "furnish and install" shall be equivalent to the word "provide".

§ 1.2.5.2 The phrase "match existing" shall mean the following:

Where Contract Documents call for exact matching, match existing work exactly in quality and appearance.

### § 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 EXECUTION OF CONTRACT

Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

*(Paragraphs deleted)*

### § 1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.6.1 For the purposes of this Contract only, the Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants, and unless otherwise indicated the Architect and the Architect's consultants shall be deemed the authors. The Owner will retain all common law, statutory and other reserved rights, including copyrights unless the Contract between the Owner and Architect provides otherwise. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' rights.

**§ 1.7 TRANSMISSION OF DATA IN DIGITAL FORM**

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Contract or the Contract Documents.

**§ 1.8 PROVISIONS REQUIRED BY LAW DEEMED INSERTED**

§ 1.8.1 Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

**ARTICLE 2 OWNER**

**§ 2.1 GENERAL**

§ 2.1.1 The Owner is the person or entity identified as such in the Contract and is referred to throughout the Contract Documents as if singular in number. Except as otherwise provided in Section 4.2.1, the Architect does not have any authority to act on behalf of the Owner. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.1.1 A staff member of the Owner shall be designated as the "Owner Representative". All contact and communication with the Owner shall be through the Owner Representative, or his or her designee. The Owner, on certain projects, may also retain the services of an outside Construction Administrator, who may be authorized to exercise certain contractual powers of the Owner Representative and/or the Architect. Should this occur, the Contractor will be advised in writing, as appropriate, of the scope and nature of this Construction Administrator's role pursuant to these Contract Documents.

§ 2.1.2 NOT USED.

**§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

§ 2.2.1 NOT USED.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall exercise proper precautions relating to the safe performance of the Work. Contractor shall review all such information and notify the Owner of any inaccuracies within twenty (20) days of its receipt.

§ 2.2.3.1 Data concerning site, size, access to site, staging and storing, present obstructions on or near the site, conditions of existing adjacent structures, locations and depths of sewers, conduits or pipes, gas lines, position of sidewalks, curbs and pavements, and other data concerning site conditions, has been obtained from sources Owner believes reliable. Accuracy of such data, however, is not guaranteed and is furnished solely for accommodation of Contractor. Use of such data is made at Contractor's sole risk and expense.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and

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relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.2.5** The Contractor shall purchase such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

### **§ 2.3 OWNER'S RIGHT TO STOP THE WORK**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. This right shall be in addition to and not in restriction or derogation of the Owner's rights under Article 14 hereof.

### **§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, after such seven (7) day period give the Contractor a second written notice to correct such deficiencies within a three (3) day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

### **§2.5 EXTENT OF OWNER RIGHTS**

**§2.5.1** The rights stated in Article 2 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (1) granted in the Contract Documents, (2) at law or (3) in equity.

**§2.5.2** In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 GENERAL**

**§ 3.1.1** The Contractor is the person or entity identified as such in the Contract and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative. The Contractor shall not replace the Contractor's representative without the prior written consent of the Owner.

**§ 3.1.2** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.3** The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

**§ 3.1.4** The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute the Contract Documents, which representations and warranties shall survived the execution and delivery of the Contract Documents and the final completion of the Work;

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- (a) That it is financially solvent, able to pay its debts as they mature and possesses sufficient working capital to complete the Work and perform its obligations under the Contract Documents;
- (b) That it, through its Subcontractors or otherwise, is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder and has sufficient experience and competence to do so;
- (c) That it is authorized to do business in the State where the Project is located and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the site of the Project;
- (d) That its execution of the Contract Documents and its performance thereof have been duly authorized by all necessary corporate action; and
- (e) That its duly authorized representative has visited the site of the Work, familiarized himself with the local conditions under which the Work is to be performed and correlated his observations with the requirements of the Contract Documents.

**§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor and all Subcontractor tiers have visited the site, become familiar with all existing conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

**§ 3.2.2** The Contractor and all Subcontractors shall visit the Project site and become acquainted with all existing conditions and conduct all tests, examinations or inspections including, but not necessarily limited to any subsurface investigations they deem necessary or as required by law, at their sole expense, to satisfy themselves as to existing conditions on the site, including sub-surface conditions. No such tests, examinations or inspections shall be conducted without the Owner's prior written approval and the Owner shall approve of any engineer or consultant engaged to perform such test, examination or inspection.

**§ 3.2.3** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect and Owner Representative any errors, inconsistencies or omissions discovered or which should have been discovered by or made known to the Contractor as a request for information in such form as the Architect and Owner Representative may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. After reporting to the Architect any error, inconsistency, or omission which the Contractor may discover in the Contract Documents, the Contractor is not to proceed with any work so affected without the Architect's written response and or clarifications and, if required, Owner approval of Contract adjustments.

**§ 3.2.4** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect and Owner Representative any nonconformity discovered, or which should have been discovered, by or made known to the Contractor as a request for information in such form as the Architect may require.

**§ 3.2.5** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities unless the Contractor recognized, or should have recognized, such error,

inconsistency, omission or difference and knowingly failed to report it to the Architect and Owner Representative immediately.

§ 3.2.6 No compensation will be allowed by reason of any difficulties which the Contractor could have discovered or reasonably anticipated, prior to execution of the Contract by visiting the project site and observing existing conditions and/or comparing these to the Contract Documents at the time of shop drawings and/or submittals.

### § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. The Contractor shall schedule and perform the Work so as not to interfere with any other related work being performed by the Owner in or about the Project site. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for any damages, losses, costs and expenses resulting from the acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The Contractor shall send its qualified representative to periodic progress meetings held at such time and at such place as Architect or the Owner shall designate in accordance with the Contract Documents.

### § 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.2.1 In connection with any requests for substitutions, the Contractor:

- .1 represents that the Contractor and Subcontractor or any applicable tier have personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
- .2 represents that the Contractor and proposed manufacturer will provide the same or superior warranty coverage for the substitution that the Contractor would for that specified;
- .3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent;
- .4 shall coordinate the installation of the accepted substitution, making such changes as may be required for the Work to be complete in all respects;
- .5 shall make requests for substitutions within fifteen (15) days after Contract award or at the preconstruction meeting; and

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- .6 shall reimburse and compensate the Owner for any costs incurred in connection with, and/or the value of, any services performed by the Architect and/or the Owner Representative associated with addressing the request for substitution.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

**§ 3.4.3.1** The Contractor shall neither permit nor suffer the use of offensive language on or about the Work embraced in this Contract.

**§ 3.4.3.2** The Contractor shall neither permit nor suffer lewd conduct on or about the Work embraced in this Contract.

**§ 3.4.3.3** All of Owner's buildings are smoke-free buildings. Additionally, the Contractor shall not permit outdoor smoking, where it creates a hazard, nor the introduction or use of drugs, spirituous or intoxicating liquors, on or about the Owner's property.

**§ 3.4.3.4** The Contractor shall be fully responsible to the Owner for the acts of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts of persons directly employed by him.

**§ 3.4.3.5** The Contractor shall familiarize himself and act in compliance with the current "President's Policy on Harassment" including its provisions prohibiting sexual harassment.

**§ 3.4.3.6** The Contractor is hereby specifically cautioned that unless specifically authorized in writing by the Owner's Executive Vice President for Administration and Chief Financial Officer or in the case of a University of Connecticut Health Center project, the Chief Administrative Officer, on a case by case basis, the Contractor shall have no right to use and shall not use, in any manner, the name of the Owner, its officials or employees, or the Seal of the Owner: (a) in any advertising, publicity, promotion; nor (b) to express or to imply any endorsement of Contractor's work product or services.

**§ 3.4.4** Directions, specifications and recommendations by manufacturers for installation, handling, storing, adjustment, and operation of their materials or equipment shall be complied with, but the Contractor shall nonetheless have the responsibility of determining whether such directions, specifications, and recommendations may safely and suitably be employed in the Work, and of notifying the Architect in advance in writing of any deviation or modification necessary for installation safety or proper operation of the item.

### **§ 3.5 WARRANTY**

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

### **§ 3.6 TAXES**

The Owner is a tax-exempt institution. The Contractor shall be familiar with the current regulations of the Department of Revenue Service. The tax on materials or supplies exempted by such regulations shall not be included as part of the Contract Sum, or any Application for Payment, or request for Change Order or other compensation. A Sales Tax Certificate is available from the Owner's Purchasing Department upon written request.

### **§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS**

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper

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execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

*(Paragraph deleted)*

§ 3.7.4 If any governmental body having jurisdiction over the Work requires licenses or registrations for the performance of the Work, or any part thereof, the Contractor shall hold such valid licenses or registrations as may be required by law to prosecute the Work to completion. If any part of the Work for which such a license or registration is required to be performed by Subcontractors of any tier, the Contractor shall ensure that any such Subcontractor holds such valid licenses or registrations as may be required by law to prosecute said Work to completion.

§ 3.7.5 **CONCEALED OR UNKNOWN CONDITIONS.** See Section 15.1.8.

§ 3.7.6 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### § 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances, except when installation is specified as part of the allowance in Division 1 Specifications; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2, except when installation is specified as part of the allowance in the General Requirements (Division 1 of the Specifications).

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 SUPERINTENDENT AND PROJECT MANAGER

§ 3.9.1 The Contractor shall employ a competent full time superintendent(s) and necessary assistants who shall be in attendance at the Project site during performance of the Work for the duration of the entire Project. The superintendent shall be satisfactory to the Owner and the Contractor shall not replace the superintendent without the prior written consent of the Owner. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

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§ 3.9.2 If not already identified as part of the Owner's pre-qualification process, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner's Representative and Architect the name, qualifications and references of the proposed superintendent(s).

§ 3.9.3 The superintendent(s) shall be satisfactory to the Owner and the Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. If for any reason the superintendent(s) is unsatisfactory, upon request of Owner, other qualified representatives shall be substituted. The Contractor shall not change the superintendent without the Owner's written consent, which shall not unreasonably be withheld or delayed.

§ 3.9.4 The Contractor shall employ a competent project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work for the duration of the entire Project. The project manager shall be satisfactory to the Owner and the Contractor shall not replace the project manager without the prior written consent of the Owner. The project manager shall represent the Contractor, and communications given to the project manager shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

§ 3.9.5 If not already identified as part of the Owner's pre-qualification process, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name, qualifications and references of the proposed project manager.

§ 3.9.6 The project manager shall be satisfactory to the Owner and the Contractor shall not employ a proposed project manager to whom the Owner or Architect has made reasonable and timely objection. If for any reason the project manager is unsatisfactory, upon request of Owner, other qualified representatives shall be substituted. The Contractor shall not replace the project manager without the prior written consent of the Owner.

§ 3.9.7 Additional key personnel may be required for this project. The Contractor shall provide additional personnel as required to ensure proper project coordination.

### § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, within ten (10) days of the date reflected on the Letter of Intent to Award, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall be in such format, and contain such information as the Owner may request or outlined in Division 1 of the Specifications. The schedule shall not exceed time limits current under the Contract Documents, shall, with the prior review and approval of the Owner and Architect, be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for simultaneous review and approval by the Owner and Architect. The Owner and Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Bid Clarifications and/or Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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§ 3.11.1.1 In addition, the Contractor shall indicate on the drawings, as best as possible, all new and existing pipe and conduit runs which are concealed in the floor slabs, walls, ceilings, etc. The Contractor shall indicate on the drawing the electrical distribution panel and circuit number supplying each item installed or reconnected, with diagrammatic lines showing sequence of connections. All changes shall be identified and circled on the Architect's and Engineer's drawings at the time they occur for each such field change.

### § 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect or Engineer without action. Such action will not be grounds for time extension to the Contract.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect and the Owner Representative in writing of such deviation at the time of submittal and (1) the Owner Representative has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities

for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.11 See Specifications for additional information on Shop Drawings.

### § 3.13 USE OF SITE

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 Nothing contained in the Contract Documents shall be interpreted as giving the Contractor exclusive use of the premises where the Work is to be performed.

§ 3.13.3 The Work in this Contract should not interfere with normal, continuous and safe operation of the buildings and site. If interference appears possible because of new connections to existing work or other reasons, the Work involved must be done at a time and in a manner approved by the Owner Representative as a part of the Contract.

§ 3.13.4 The Contractor shall comply with the following procedures when working in occupied areas including classrooms, hallways, and office spaces:

§ 3.13.4.1 **Notification:** The Contractor shall notify the Owner Representative and the Building Safety Committee Representative two (2) days prior to commencing work in occupied office, classroom and other areas. This notification shall include detailed description of proposed work.

§ 3.13.4.2 **Overhead Work:** There shall be no overhead work, (e.g. demolition, HVAC ductwork, and/or electrical) performed directly over occupied spaces.

§ 3.13.5 The Contractor shall produce a site mobilization plan for the Owner Representative's review and approval before beginning operations on site. This document shall be updated and submitted monthly. No deviations will be allowed without the prior approval of the Owner.

### § 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.14.3 Written permission shall be obtained from the Architect/Engineer before cutting beams, arches, lintels or other structural members.

§ 3.14.4 See Specifications for additional information on Cutting and Patching.

### § 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials and shall clean and/or remove all stains, spots, marks, blemishes, foreign matter and dirt from surfaces of the Work and from other surfaces not a part of the Work but where such conditions resulted from the Contractor's operations from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect. In the event of legal action arising out of such infringement for which the Contractor is responsible and which action has the effect of stopping the Work, the Owner may require the Contractor to substitute other products of like kind as will make it possible to pursue and complete the Work. Costs and expenses caused thereby shall be borne by the Contractor.

### § 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall defend, indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the willful, wanton or negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18. Nothing in this Section shall be construed as obligating the Contractor to indemnify or hold harmless any of the parties indemnified hereunder against liability for damage arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of any such indemnified party, or such party's agents or employees.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.18.3 The Contractor further agrees to obtain and maintain at its expense such general liability insurance coverage as will insure the provisions of this Section and other contractual indemnity obligations assumed by the Contractor in this Contract.

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**§ 3.18.4** The Contractor shall defend, indemnify and hold harmless the Owner, the Architect, and the Architect's consultants and their agents and employees from and against all claims, damages, losses, including, but not limited to, attorneys fees, arising out of or resulting from any type of pollution and/or environmental impairment into or upon the land, the atmosphere, or any course or body of water that is above or below ground, which is caused by any negligent or willful or wanton act or omission of the Contractor, subcontractors, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. The Contractor shall further indemnify and hold harmless the Owner, the Architect, and the Architect's consultants, and the agents and employees of any of them, as set out above for any acts that are outside of the contract specifications, and without the supervision or direction of the Owner, its Architects and Engineers; additionally this same indemnification shall apply to the misuse or malfunction of any equipment rented, owned, or leased by the Contractor, subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts they may be liable. Nothing in this Section shall be construed as obligating the Contractor to indemnify or hold harmless any of the parties indemnified hereunder against liability for damage arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of any such indemnified party, or such party's agents or employees.

The Owner assumes no responsibility or liability from loss or damage to the Contractor's equipment, materials, or supplies.

#### **ARTICLE 4 ARCHITECT**

##### **§ 4.1 GENERAL**

**§ 4.1.1** The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Contract and is referred to throughout the Contract Documents as if singular in number.

**§ 4.1.2** Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

**§ 4.1.3** If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

##### **§ 4.2 ADMINISTRATION OF THE CONTRACT**

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

**§ 4.2.2.1** Where it is stated in the Contract Documents that the Contractor shall pay for or reimburse the Owner for services of the Architect, such payment shall be at a rate of two and one half (2.5) times the Architect's Direct Personnel Expense plus any expenses incurred in providing such services. Direct Personnel Expense is defined as the direct salaries of the architect's personnel engaged on the Project and the portion of the cost of their mandatory and customary contributions and benefits related thereto, such as employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions and similar contribution and benefits.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or

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charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

**§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION**

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

**§ 4.2.5** Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

**§ 4.2.6** The Owner Representative has authority to reject Work that does not conform to the Contract Documents. Whenever the Owner Representative considers it necessary or advisable for implementation of the intent of the Contract Documents, the Owner Representative will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. The Architect shall advise and assist the Owner Representative in performing any of the functions set forth in this Section.

**§ 4.2.7** The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

**§ 4.2.8** The Owner Representative or the Architect will prepare Change Orders and Construction Change Directives and may authorize minor changes in the Work as provided in Section 7.4..

**§ 4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10. The undertaking of any inspections by the Architect is not to be construed as supervision of actual construction, nor to make the Architect responsible for providing a safe place for the performance of work by the Contractor of the Contractor's employees, or those of suppliers of subcontractors for access, visits, work, travel, or occupancy by any person.

**§ 4.2.10** NOT USED.

**§ 4.2.11** The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until fifteen (15) days after written request is made for them.

**§ 4.2.12** Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and

decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The decisions of the Owner Representative, with the advice and consultation of the Architect on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable from the date of the Letter of Intent to Award, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within fourteen (14) days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection. The Contractor shall submit the list of the subcontractors along with their CT registration number and FEIN or social security number if no FEIN number is available, within ten (10) days of the Letter of Intent to Award.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.2.1 The Contractor shall not contract with a person or entity who appears on the State of Connecticut Debarment List, the Federal Davis Bacon Act Debarment List, both of which are available through:

<http://www.ctdol.state.ct.us/>

or the Federal List of Excluded Parties Listing System available through <http://epls.arnet.gov/>

or who is party to a legal dispute with the State of Connecticut.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work and is not ineligible to be contracted with in accordance with Section 5.2.2.1, the Contract Sum and/or Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity (including those who are to furnish materials or equipment fabricated to a special design) previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.2.5 As set forth more fully in the Notice and Instructions to Proposers, if the value of the masonry, electrical, mechanical (other than HVAC) and HVAC work each exceeds \$25,000, the Contractor may be required to list the names and prices of Subcontractors for masonry, electrical, mechanical other than HVAC, and HVAC work, as well as other Subcontractors or as may be required by the Bid Documents. Substitution of a Subcontractor for one named in the Bid Document, or substitution of a Subcontractor for any designated sub trade work bid to be performed by the Contractor's own forces, shall not be permitted, except for good cause. The term "good cause" includes but is not limited to a Subcontractor's or where appropriate, Contractor's: (1) death or physical disability, if the listed Subcontractor is an individual; (2) dissolution, if a corporation or partnership; (3) bankruptcy; (4) inability to furnish any performance and payment bonds shown on the Proposal Form; (5) inability to obtain, or loss of, a license necessary for the performance of a particular category of work; (6) failure or inability to comply with a requirement of law applicable to Contractors, Subcontractors, or construction, alteration, or repair projects; and (7) failure to perform its agreement to execute a Subcontract, as set forth in the Bid Documents.

### § 5.3 SUBCONTRACTUAL RELATIONS

§ 5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.2 Any Subcontract must be in the form as provided by the Owner in accordance with Section 4b-96 of the Connecticut General Statutes. Supplements or other forms of Subcontracts are permitted as long as all the basic elements of the Connecticut General Statutes Section 4b-96 form are covered. In the event of any conflict or inconsistency between the Connecticut General Statutes Section 4b-96 Subcontract form as provided by the Owner and the Contractor's standard Subcontract form, the provisions of the Connecticut General Statutes Section 4b-96 Subcontract form shall prevail. Any standard Subcontract form used will be attached as a supplement to the Connecticut General Statutes Section 4b-96 Subcontract form as provided by the Owner.

Within five days after being notified of an award of a general contract by the University or, in the case of an approval of a substitute Subcontractor by the Owner, within five days after being notified of such approval, the Contractor shall present to each listed and approved Subcontractor, or approved Substitute Subcontractor, which will be performing masonry, electrical, mechanical other than HVAC, or HVAC work, or which will be performing other subcontract work which the Owner has designated in the Bid Documents as applicable to the following requirements:

1. A Subcontract in the form as described above.
2. A notice of the time limit under this section for executing a Subcontract.

If such Subcontractor fails within five days, Saturdays, Sundays and legal holidays excluded after presentation of a Subcontract by the Contractor to execute a Subcontract in the form hereinafter set forth, the Contractor shall propose another Subcontractor for the Owner's consideration and approval. When seeking approval for a substitute Subcontractor, the Contractor shall provide the University with all documents showing (A) the Contractor's proper presentation of a Subcontract to the listed Subcontractor and (B) communications to or from such Subcontractor after such presentation. The Owner shall adjust the Contract Price to reflect the difference between the amount of the price of the new Subcontractor and the amount of the price of the prior Subcontractor if the new Subcontractor's price is lower and may adjust such Contract Price if the new Subcontractor's price is higher. The Contractor shall, with respect to each such Subcontractor or approved substitute Subcontractor, file with the Owner a copy of each executed

subcontract within ten days, Saturdays, Sundays and legal holidays excluded, of presentation of a Subcontract to such Subcontractor.

#### **§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

**§ 5.4.1** Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract. Contractor agrees to execute any and all other documents reasonably required to effect the assignment.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than thirty (30) days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

**§ 5.5** The Contractor shall promptly advise the Owner in writing of any claim or demand by a Subcontractor claiming that any amount is due to such Subcontractor or claiming any default by the Contractor in any of its obligations to such Subcontractor.

#### **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

##### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules and construction requirements. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement between the Owner and Contractor. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

##### **§ 6.2 MUTUAL RESPONSIBILITY**

**§ 6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly

report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable. If any part of a Contractor's work depends on proper and timely execution or relies upon the interphasing or coordinating of the work of any other separate Contractor, or the Owner, the Contractor shall allow for this interrelationship in the planning and performance of his work, without interference to any other contractor.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Owner Representative will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor.

All changes to the Work shall be approved by the Owner Representative. Except as permitted in Section 7.3, a change in the Contract Sum or the Contract Time shall be accomplished only by Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alterations or additions to the Work, whether or not there is, in fact, any unjust enrichment shall be the basis for any claim for an increase in any amounts due under the Contract Documents or a change in any time period provided for the Contract Documents.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

### § 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Owner or Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

There shall be no extension in the Contract time unless the Contractor can effectively demonstrate that the Work delayed is on the critical path of the Project Schedule in accordance with Section 8.3.

The signature of the Architect signifies that he has reviewed the change proposed, with accompanied breakdowns and subcontractors change proposals for appropriate quantities and unit costs and recommends the change. However, if the Contractor and the Owner Representative have signed the change order, the Architect's signature is not necessary

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in order for the Change Order to constitute a modification to the Contract which binds the Owner and the Contractor.

#### **§ 7.2.2 CHANGE ORDER COST COMPONENTS**

The contractor's proposal for a change in the Work shall be itemized completely, submitted in a detailed format acceptable to the Owner and shall include the following itemized cost components, as appropriate:

##### **§ 7.2.2.1 Engineered Equipment and Materials:**

**Engineered Equipment** shall be defined as equipment specified by the contract from a single manufacturer. **Material** (bulk materials) shall be defined as permanent construction materials that become part of the completed installation. Engineered Equipment and Material costs shall be considered all-inclusive of the purchase cost of the equipment including all freight costs, purchasing services, expediting, and inspections and shall be substantiated by manufacturer quotes subject to review and approval by the Owner's representative, with the advice of the Architect.

##### **§ 7.2.2.2 Direct Field Labor Hours:**

Direct labor work hours for change orders shall be itemized indicating the estimated direct labor to be expended in the actual installation of equipment and materials that will become a permanent part of the finished project. The quantity of hours shall be based upon the contractor's estimate to complete the work based upon actual field conditions subject to review and approval by the Owner's representative, with the advice of the Architect.

##### **§ 7.2.2.3 Direct Field Labor Costs:**

Direct field labor costs are defined as cost of the direct labor estimated in the actual installation of equipment and materials that will become a permanent part of the finished project. Direct field labor may include hourly labor classifications for foremen, journeymen, apprentices, laborers, etc. Direct field labor costs may include contractor's direct labor payroll costs including social security, unemployment (federal and state), workers' compensation insurance, fringe benefits, and any other identified costs directly related to direct labor subject to review and approval by the Owner's representative, with the advice of the Architect.

The contractor's direct labor rates as outlined above are to be substantiated by a detailed direct labor cost breakdown with associated back-up support in a form acceptable to the Owner.

If the project is subject to prevailing wage rates, no wage above the prevailing rate shall be allowed unless such rate is substantiated by documentation of actual wages paid in the proposed amount or subject to labor rates submitted and accepted by the Owner as part of the contract documents.

##### **§ 7.2.2.4 Construction Equipment and Tool Rental:**

Contractor owned or rented equipment and major tools costs are allowed as part of the cost of a Change Order if it is demonstrated to the Owners satisfaction that such costs are valid and related to the change in work. Major tools shall be defined as non-hand held tools. Pricing rates for equipment and major tools shall be acceptable if agreed to by the Owner. In such cases, equipment costs shall be submitted for review and approval by the Owner, with the advice of the Architect. Changes that require specialized equipment not already on site shall have costs shown separately and shall include justification.

##### **§ 7.2.2.5 Field Overheads (Indirects):**

Field overhead (indirect) labor shall include field (onsite) supervision (superintendent, general foremen, field engineers)

Field overhead (Indirects) are allowed as part of a cost of a Change Order if it is demonstrated to the Owners satisfaction that such costs are valid and related to the change in work. In such cases additional costs of supervision and directly attributable to the change based on supporting data additional shall be submitted for review and approval by the Owner, with the advice of the Architect. The hourly rate for such personnel shall be based upon rates submitted to and approved by the Owner with the advice of the Architect. Changes that require specialized personnel or additional staff shall have costs shown separately and shall include justification.

Field Facilities shall include the following classifications, as applicable:

1. Temporary offices (office furniture, copiers, computers, printers, other office equipment and supplies)
2. Temporary material storage (storage vans and containers, warehouse rental)

3. Utilities (electricity, phones, data lines, restroom facilities)

Field Facilities costs are not allowed as part of the costs of a Change Order except in the event that a change involving an adjustment in contract time is submitted and approved in accordance with Section 8.3 or for changes that do not impact the critical path, it is demonstrated to the Owners satisfaction that such incremental costs are valid and related to the change in work. In such cases, Field Facilities costs shall be submitted for review and approval by the Owner, with the advice of the Architect.

§ 7.2.2.6 As noted in Section 3.6, the Owner is a tax exempt institution. The tax on materials or supplies exempted by the current regulations of the Department of Revenue Services shall not be included as a cost component of any Change Order or Change Order request/proposal.

§ 7.2.2.7 **Subcontractors:**

Subcontractors shall adhere to the same contract requirements and shall utilize change order pricing methodology that is consistent with the general contractor's contractual agreement with the owner. Include detailed Subcontractor cost proposals as backup to all subcontractor pricing.

§ 7.2.2.8 **General and Administrative Overhead (Home Office) Costs and Profit (Overhead and Profit):**

Overhead and Profit shall be applied as a percentage to the total cost of the change and shall include:

1. All home office expenses;
2. Safety related items, including safety equipment, safety administration, and all related costs associated with the contractor's safety program;
3. Small tools, which are defined as construction tools with a value of up to \$500;
4. Consumable materials, which are normally used in the execution of the work and as may be further defined in the general conditions section of the specifications;
5. Indirect costs as related to field administrative personnel (project manager, field safety supervisor, planners, estimators, office manager, secretarial services, document control);
6. Indirect costs as related to support staff ;
7. Commercial General, Automobile, Umbrella, Aircraft and Contractor's Pollution Liability Insurance as described in Section 11.1.2;
8. Parking;
9. Safety;
10. Commissioning Requirements;
11. Such other items as are commonly considered part of home office overhead;
12. Company vehicles, gas, d mileage and travel time;
13. Union-related contributions, fees, expenses and costs;
14. Any training; and
15. Licenses.

§ 7.2.2.9 The determination of overhead and profit allowance for a contract change shall be based on the total direct cost of the work including material, labor, and equipment cost, as appropriate, utilizing the Contractor/Subcontractor Combined Overhead and Profit Markup Table as follows:

<b>Contractor/Subcontractor Combined Overhead and Profit Markup Table:</b>	
Contractor markup on self performed work	15%
Contractor markup on subcontractor work.	5%
Subcontractor markup on self performed work.	15%
Subcontractor markup on first tier sub-subcontractor work.	5%
Sub-subcontractor markup on self performed work.	10%
Subcontractor markup on Sub-subcontractor subtier work	0%
Sub-subcontractor markup on subtier work.	0%

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§ 7.2.2.10 Upon computing of the direct costs and applying the Section 7.2.2.9 mark ups to the direct costs on a compounded basis, the aggregate allowance for overhead and profit on any contract change shall not exceed twenty percent (20%).

§ 7.2.2.11 Overtime, when specifically authorized by the Owner and not as an Extraordinary Measure (as defined in Section 8.2.3.2), shall be paid for by the Owner on the basis of premium payment only, plus the cost of insurance and taxes based on the premium payment period.

§ 7.2.2.12 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Owner Representative. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.2.2.13 If the Contractor does not expeditiously proceed with the work in dispute, the Owner may, in its sole discretion, cause the work to be performed by other forces, and may issue a Change Order deducting the actual cost of the work to the Owner from the Contract Sum.

§ 7.2.2.14 Bond Costs: Actual additional bonding costs associated with the value of the Change Order will be compensable only when supported by written documentation by the bonding company that the Change Order requires an increase to the original Performance, Payment, Labor or Material Bond. Such Bond Costs will be adjusted as a final Change Order to the Contractor with no additional fee or mark-up.

§ 7.2.3 The Contractor shall submit cost proposals only on "Change Order Proposal Request Form" provided in Division 1 of the Specifications or on a form and in a format acceptable to the Owner. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, unit prices, and Subcontracts. Subcontract proposals included in any work shall also be itemized.

§ 7.2.4 Alternates awarded by Change Order after Contract execution are not subject to Contractor, Subcontractor or Subcontractor tiers overhead and profit mark-up.

§ 7.2.5 Agreement upon and execution of any Change Order shall constitute a final settlement of all matters relating to the change in the Work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the construction schedule. In the event a Change Order increases the Contract Sum, Contractor shall include the Work covered by such Change Orders in Application for Payment as if such Work were originally part of the Contract Documents.

§ 7.2.6 Any percentage referred to hereafter for General Conditions, and/or Overhead and Profit included in the adjustment to the Contract Sum shall be applied to the costs of performing the work attributable to the change as stated in 7.3.7.1 through 7.3.7.6. No markup shall be allowed for premiums on bonds and insurance.

### § 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Owner Representative or Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly. The signature of the Architect signifies that he has reviewed and recommends the change. However, if the Owner Representative has signed the Change Directive the Architect's signature is not necessary in order for the Change Directive to be valid

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for a proposed adjustment to the Contract Sum and/or Contract Time, the adjustment shall be based on one of the following methods:

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- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. The Contractor must proceed promptly regardless if the directive is signed by the Contractor.

§ 7.3.7 If the contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method for adjustment in the Contract Sum and/or Contract Time shall be determined at the sole discretion of the Owner Representative, on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit in accordance with Section 7.2. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Owner Representative may prescribe, an itemized accounting together with appropriate supporting data. Any increase to Contract time will be limited to only changes that have been demonstrated through a critical path analysis in conformance with Section 8.3 and Division 1 of the Contract Documents to extend the Project end date. Unless otherwise provided in the Contract Documents, costs of performing the Work attributable to the changes for the purposes of this Section 7.3.7 shall be limited to the following as defined in Section 7.2:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools and any hand-held equipment, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of field overhead personnel directly attributable to the change based on supporting data.
- .6 If the Contractor does not expeditiously proceed with the work in dispute, the Owner may, in its sole discretion, cause the work to be performed by other forces, and may issue a Change Order deducting the actual cost of the work to the Owner from the Contract Sum.

§ 7.3.8 If the Contractor does not expeditiously proceed with the work in dispute, the Owner may, in its sole discretion, cause the work to be performed by other forces, and may issue a Change Order deducting the actual cost of the work to the Owner from the Contract Sum.

§ 7.3.9 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Owner Representative. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 NOT USED.

§ 7.3.10 When the Owner and Contractor agree concerning the adjustments in the Contract Sum and/or Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be

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recorded by preparation and execution of an appropriate Change Order, Change Orders may be issued for all or any part of a Construction Change Directive.

#### **§ 7.4 MINOR CHANGES IN THE WORK**

The Architect, subject to approval of the Owner Representative, has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

### **ARTICLE 8 TIME**

#### **§ 8.1 DEFINITIONS**

**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Notice to Proceed.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

**§ 8.1.4** The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### **§ 8.2 PROGRESS AND COMPLETION**

**§ 8.2.1** Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Contract the Contractor confirms that the Contract Time is a reasonable period for performing the Work and that the Contractor is capable of properly completing the Work within the Contract Time.

**§ 8.2.2** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

**§ 8.2.3.1** The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. The accepted construction schedule shall be updated to reflect actual conditions (sometimes referred to as progress reports) as set forth in Section 3.10.1 of AIA Document A201 or if requested by the Owner. In the event any progress report indicates any delays or potential delays, the Contractor shall advise the Owner of its plan to recover the schedule, providing the Owner with a recovery schedule, and shall further take all steps necessary to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report or recovery schedule constitute an adjustment in the Contract Time or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

**§ 8.2.3.2** In the event the Owner determines that the performance of the Work has not progressed or reached the level of completion required by the approved construction schedule for reasons within the responsibility of the Contractor, the Owner shall have the right to order the Contractor to take any and all corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities and (3) other similar measure (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measure shall continue until the progress of the Work complies with the stage of completion required by the approved construction schedule. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

**§ 8.2.3.3** The Contractor shall not be entitled to any adjustment in the Contract Price in connection with Extraordinary Measures required by the Owner, if the Owner determines that the conditions creating the need for such Extraordinary Measures were within the responsibility of the Contractor.

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§ 8.2.3.4 The Owner may exercise the rights furnished the Owner under or pursuant to this Section as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any approved construction schedule or completion date established in accordance with the Contract.

§ 8.2.4 The Contractor and the Owner agree that the times specified for the performance of the Contract shall include not only the work of the original Contract but any additional work ordered by the Owner which, in the opinion of the Owner Representative, can be performed concurrently with the original work specified and therefore do not warrant the granting of an extension of time.

§ 8.2.5 Except in the event of emergency, no substantial field operations shall be performed outside of regular working hours without the prior approval of the Architect and the Owner. The Contractor shall not be entitled to additional compensation for work performed outside of regular working hours.

### § 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, or unavoidable casualties beyond the Contractor's control, then the Contract Time may be extended by Change Order for such reasonable time periods as demonstrated through a Critical Path Analysis in conformance with Division 1 of the Contract Documents and accepted by the Owner Representative.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.2.1 Claims of delay and requests for extension of time shall set forth in detail the circumstances of such claim, the dates upon which claimed delay began and ended, and the number of days' extension of time requested. The Contractor shall provide supporting documentation as the Architect and Owner may require, including a revised Construction Schedule indicating the affect of the circumstances which form the basis for the claim.

§ 8.3.2.2 The contractor shall not be entitled to an extension of time for each and every one of a number of causes which have a concurrent and interrelated effect on the progress of the Work.

§ 8.3.2.3 Claims for extension of time arising out of authorized changes in the Work shall be made in writing prior to or concurrent with the submission of the Contractor's proposal for such change. No extension of time arising out of changes in the Work will be granted after the date upon which the Contractor is authorized to proceed with such change unless specific provision for an extension of time has been incorporated in the authorization.

§ 8.3.2.4 Any additional cost to the contractor arising from such change shall be included in the amended Contract Sum set forth in such Change Order. No claim for damages for delay, arising from such change in the Work, shall be recognized or be deemed valid.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Contract and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

§ 9.2.1 Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Owner Representative may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.2.1.1 Submission of the Schedule of Values shall be made within five (5) days for projects under One Million Dollars (\$1,000,000.00) and for all others within thirty (30) days of the Contract execution.

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**§ 9.2.1.2** The Schedule of Values shall be submitted (typewritten) on an AIA Document G702 form and should be broken down into a minimum of sixteen (16) divisions based on the Construction Specifications Institute (CSI) Guidelines and subdivided further by Materials and Labor.

### **§ 9.3 APPLICATIONS FOR PAYMENT**

**§ 9.3.1** By the twenty-fifth of each month, the Contractor shall submit to the Owner Representative and the Architect a Draft Application for Payment for Work in the form of an AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet. The latest edition of each document must be used.

The Owner Representative and the Architect will within ten (10) days after receipt of the Contractor's Draft Application for Payment notify the Contractor in writing of all necessary revisions.

The Contractor shall make all revisions to the Application for Payment as required by the Owner Representative.

The Contractor shall then submit to the Owner Representative and the Architect an Application for Payment for Work in the form of a notarized AIA Document G702, Application for Payment, supported by AIA Document G703, Continuation Sheet, free of any handwritten, marks, notes, annotations, etc. and an Affidavit of Payment and Release of Claims form (either partial release or final release as appropriate) in a form as provided by the Owner.

By submission of the Affidavit and the Application for Payment the Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown therein is now due.

**§ 9.3.1.1** Each payment requisition submitted by the Contractor shall include a statement showing the status of all pending construction change orders, other pending change directives and approved changes to the original contract or subcontract. Such statement shall identify the pending construction change orders and other pending change directives, and shall include the date such change orders and directives were initiated, the costs associated with their performance and a description of any work completed. As used in this subsection, "pending for construction change order" or "other pending change directive", means an authorized directive for extra work that has been issued to a contractor or a subcontractor.

**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

**§ 9.3.1.3** Such Application for Payment shall include a deduction of ten (10%) percent of the estimated amount of the application to be retained by the Owner until the completion of the entire Contract in an acceptable manner. The Contractor shall be prohibited from withholding more than ten (10%) percent retainage from any payment which is otherwise due to any Subcontractor.

**§ 9.3.1.3.1** In addition, if the State Commission on Human Rights and Opportunities ("CHRO") authorizes the award or execution of this contract in advance of CHRO's approval of the Affirmative Action Plan required to be submitted by the Contractor pursuant to Connecticut General Statutes Section 46a-68d, the Owner will withhold an additional two percent (2%) of the total contract price per month from any payment made to such Contractor, until such time as the Contractor has received approval from CHRO of the Affirmative Action Plan. Moreover, if CHRO determines through its complaint procedure and the hearing process provided in Connecticut General Statutes Section 46a-56(c) that a contractor or subcontractor is not complying with anti-discrimination statutes or contract provisions required under Connecticut General Statutes Section 4a-60 or 4a-60(a) or the provisions of Connecticut General Statutes Section 46a-68c to 46a-68f, inclusive, and if so ordered by the presiding officer after such hearing and upon a finding of noncompliance, the University shall retain two percent (2%) of the total contract price per month on the contract with the Contractor.

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§ 9.3.1.4 Whenever the Owner has designated a separate section for a class of work the Contractor shall, when applicable, state as part of its application for partial payment that it considers the work required to be done under any such separate section to be fully completed in accordance with the terms of the Contract. The Owner shall thereupon conduct an inspection of the work in such class, and if it finds that such work has been fully completed in accordance with the terms of the Contract, it shall issue a statement certifying that such work is accepted as fully completed, and shall pay the Contractor in full for such work.

§ 9.3.2 Unless otherwise specifically approved, the Owner will pay only for material and equipment delivered and incorporated in the Work. If approved in advance by the Owner, payment may be similarly made for material and equipment suitably stored on site or off site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.2.1 Payment for stored material either on site or off site will require Owner's prior approval. Approval will be dependent upon demonstration of hardship due to extended time duration between required purchase and actual field installation or the critical nature of the commodity in relationship to the critical path of the construction schedule. Additionally, the Contractor must provide secured storage, insurance coverage for the material during storage, transfer of ownership of the material to the Owner and indemnify the Owner from any delay, cost associated with or resulting from, the loss or damage of such material during such storage. Payment for such material will be paid for at 80% of invoice verified cost. No stored payment will be considered for raw materials. Those items requiring fabrication must be complete so that identification and appropriate documentation can be obtained to insure such items are part of the work identified in this Contract.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 If payment for stored products is approved, Contractor shall furnish with Application for Payment a vendor invoice establishing value of material and equipment stored along with a statement of amount to be paid to vendor.

§ 9.3.4.1 Such stored items are subject to prior approval for storage and to inspection by Architect and Owner before payment is recommended.

§ 9.3.4.2 Contractor shall give Owner Certificates of Insurance in accordance with Contract Documents for the full value of the items stored. Insurance to be maintained until items are incorporated in the Work.

#### § 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or

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procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect following consultation with the Owner Representative may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. The Architect following consultation with the Owner Representative may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 after prior notice, defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless full bond coverage, insurance or security acceptable to the Owner is provided by or demonstrated by the Contractor, or unless the Contractor demonstrates to the Owner that the claims do not have a reasonable basis in fact;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment in accordance with the provisions of this Contract;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 injury to persons or damage to the Work or property of the Owner, other Contractors, or others caused by the act of neglect of the Contractor or any of his Subcontractors;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance of the Contract Sum would not be adequate to cover actual or liquidated damages for the anticipated delay unless the Contractor demonstrates to the satisfaction of the Owner that it or others for whom it is responsible are not responsible for such delay;
- .7 repeated failure to carry out the Work in accordance with the Contract Documents;
- .8 failure to submit Construction Schedules as outlined in Division 1 of the Specifications in the time prescribed;
- .9 failure to submit all documents necessary for compliance with CHRO requirements;
- .10 failure to submit all copies of all certified payrolls;
- .11 failure to provide copies of subcontractors contracts per statute; or
- .12 failure to submit any other documentation requested by the Owner necessary for compliance with the requirements of any regulatory agency.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld. The Owner shall not be deemed in default by reason of withholding payment while any of the above grounds remain uncured, nor shall any interest accrue or be payable with respect to any payments so withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.5.4 The Owner shall have the right to apply any such amounts so withheld in such manner, as the Owner may deem proper to satisfy such claims or to secure such protection. Such application of such amounts shall be payments to the Contractor.

#### § 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has certified the Application for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, or shall so notify the Contractor of the Owner's intent to withhold payment to the extent reasonably necessary to protect the Owner from loss for which the Contractor is

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responsible, including loss resulting from acts and omissions of its Subcontractors due to the causes set forth in Section 9.5.1.

§ 9.6.2 For every Contract with the Owner for the construction, alteration or repair of any building or work;

- .1 The Contractor within thirty (30) days after payment to the Contractor by the Owner, shall be required to pay any amounts due any Subcontractor, whether for labor performed or materials furnished, when the labor or materials have been included in a requisition submitted by the Contractor and paid by the Owner;
- .2 The Contractor shall include in each of its subcontracts a provision requiring each Subcontractor to pay any amounts due any of its Subcontractors, whether for labor performed or materials furnished, within thirty (30) days after each Subcontractor receives a payment from the Contractor which encompasses labor or materials furnished by such Subcontractor.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Pursuant to Connecticut General Statutes Sections 10a-109a through 10a-109y:

- .1 No payments shall be made by the Owner on account of this Contract for this project until the bills or estimates presented for such payments shall have been duly certified to be correct by the Owner;
- .2 The obligations of the Owner or the State of Connecticut to make payments to the Contractor for services, labor, or materials provided on this project are limited to those amounts set forth in the Contract Documents and any agreed upon changes or amendments thereto. Neither the Owner nor the State of Connecticut shall or may be liable to make payments in excess of such amount.

#### § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven (7) additional days' written notice to the Owner and Architect be entitled to the applicable statutory interest.. Said provision does not apply where the Owner has submitted to the Contractor its intention to withhold payment in accordance with Section 9.6.1 or where the Architect has submitted to the Contractor its intention to withhold certification in accordance with Section 9.5.1.

#### § 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize without impact or interruptions the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. The Certificate of Substantial Completion shall become valid upon the written approval thereof by the Owner Representative. Upon such acceptance and written consent of Contractor's surety, if any, and a written statement from CHRO releasing the Owner from any obligation to withhold amounts retained under Section 9.3.1.3.1, the Owner shall make payment of retainage applying to such Work or designated portion thereof. At the sole discretion of the University, reductions in retainage may be allowed before the Contractor reaches Substantial Completion. Such reductions shall not be allowed without written consent from the Contractor's surety. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.6 **Certifications.** The Contractor at completion of construction shall provide to the Owner a "Certificate of Substantial Compliance" bearing original signatures of an officer of the company stating: "This is to CERTIFY that in my professional opinion the complete structure/renovations described above is in substantial compliance with the approved construction documents on file with the University of Connecticut. Minor deviations and special stipulations are noted below (if any)".

#### § 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in

accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, (6) all documents necessary for compliance with CHRO requirements and as required to obtain the written statement of release from CHRO referenced in Section 9.8.5, (7) copies of all certified payrolls, (8) certifies that all material installed does not contain asbestos, (9) the Certificate of Substantial Compliance referenced in Section 9.8.6, and (10) any other documentation requested by the Owner necessary for compliance with the requirements of any regulatory agency. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such claim. If such claim remains unsatisfied after payments are made to the Contractor, the Contractor shall promptly pay to the Owner all money that the Owner may be compelled to pay in discharging such claim, including all costs and reasonable attorneys' fees.

**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor, the written approval of the Owner Representative and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**§ 9.10.4**  
*(Paragraphs deleted)*  
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**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

#### **§ 9.11 LIQUIDATED DAMAGES**

**§ 9.11.1** Time is of the essence to the Contract Documents and all obligations there under. The Contractor acknowledges and agrees that if the Contractor fails to achieve Substantial Completion, or causes any delay to the Substantial Completion of any portion of the Work within the Contract Time, as may be extended by the Owner, the Owner will sustain extensive damages and serious loss as a result of such failure. The exact amount of such damages will be difficult to ascertain. Therefore, the Owner and the Contractor agree as follows:

- .1** If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the per diem sum of Five Hundred Dollars (\$500.00) for every calendar day that the Contractor is in default, commencing upon the first day following the expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed completion of the Work.

- .2 The Owner shall be entitled to recover as actual damages the Owner's costs, expenses and damages it incurs in connection with the completion of the Work in the event that the Contractor fails to complete the Work, and/or the Contractor's surety fails to perform the Work pursuant to any Performance Bond.  
The Owner shall be entitled to recover as actual damages any payments it makes to any subcontractor or materials supplier that the Contractor's surety fails to pay pursuant to any Payment Bond.
- .3 The Owner may deduct liquidated damages described in Clause 9.11.1.1 from any unpaid amounts then or thereafter due the Contractor under this Contract. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner, together with interest from the date of the demand at the legal rate.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 SAFETY PRECAUTIONS AND PROGRAMS

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. Prior to and as a condition of mobilization on site, the Contractor shall submit a Safety Plan to Owner. To the extent the Owner provides safety manuals or other information, any such manuals and information shall be deemed minimum requirements for the Contractor's fulfillment of its safety obligations. Safety fines may be assessed based on Owner's safety plan and or Occupational Safety and Health Administration ("OSHA").

§10.1.1.1 In accordance with C.G.S. Section 31-53b, the Contractor is required to submit proof that each employee has completed a course of at least ten hours in duration in construction safety and health approved by the federal OSHA.

§10.1.1.2 The Contractor shall remove all snow and ice as may be required for the proper protection and/or prosecution of the Contractor's work. The Contractor shall coordinate and cooperate with the Owner for such activities.

§ 10.1.2 **Contractors Safety Program:** The Contractor hereby acknowledges that the job site safety will be of utmost importance. Contractor shall be responsible for initiating, maintaining and supervising safety and anti-substance abuse precautions and programs in connection with the Work. Contractor shall provide all protection to prevent injury to all persons involved in any way in the Work and all other persons, including, without limitation, the employees, agents, guests, visitors, invitees and licensees of the Owner who may visit or be affected thereby. These precautions shall include, but in no event be limited to: (1) those set forth in the most current provisions of the Owner's Contractor Environmental Health and Safety Manual, which is incorporated by reference as a Contract Document; (2) the posting of danger signs and personal notification to all affected persons of the existence of a hazard of whatever nature; (3) the furnishing and maintaining of necessary traffic control barricades and flagman services; (4) the use, or storage, removal and disposal of required explosives or other hazardous materials only under the supervision of qualified personnel and after first obtaining permission of all applicable governmental authorities; (5) and the maintenance of adequate quantities of both hose and operable fire extinguishers at the job site. The Contractor shall set forth in writing its own safety and anti-substance abuse precautions and programs in connection with the Work and if requested by the Owner submit the same to the Owner or its designee for review. The Owner may but shall not be obligated to make suggestions and recommendations to the Contractor with respect thereto.

- .1 **Compliance of Work, Equipment and Procedures with all Laws:** All Work, whether performed by the Contractor and its Subcontractors of any tier, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with and conform to: (a) all applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental bodies relating to the safety of persons and their protection against injury, specifically including, but in no event limited to the Federal Occupations Safety and Health Act of 1970, as amended and all rules and regulations now or hereafter in effect pursuant to said Act and the OSHA Act of the State of Connecticut, as amended and all rules and regulations now or hereafter in effect pursuant to said Act; and (b) all rules, regulations and requirements of the Owner and its insurance carriers relating thereto, including without limitation the O. In the event of conflicting provisions the more stringent shall govern. The Owner reserves the right to assess fines and penalties to the Contractor for violations of the Owner's Contractor Environmental Health and Safety Manual as may be more specifically referred to in the Manual and may deduct such fines and penalties from any payments due the Contractor under the Contract.

- .2 **Contractors Designation of Safety Program Administrator:** The Contractor shall designate a qualified member of its organization at the job site in accordance with the requirements of the Owner's Contractor Environmental Health and Safety Manual whose duties shall include enforcement of the Contractor's Safety Program to assure compliance with Article 10 and to prevent accidents. This position may be required to be a full time position dedicated to this Project. This person's name, qualifications and the estimated number of man-hours of effort per week performing this function shall be submitted to the Owner in writing. His or her identity, qualifications and level of effort must be satisfactory to the Owner who shall have the sole discretion to approve or reject same. Any reduction to this schedule must be submitted to the Owner for approval. The Contractor shall further cause each of its Subcontractors of any tier to designate a qualified safety representative to assist the Contractor's Representative in the performance of its duties as described above and the names of such representative shall be given to the Owner.
- .3 **Suspension of Contractor's Work:** If in the opinion of the Owner or its designee the Contractor shall fail to provide a safe area for the performance of the Work or any portion thereof the Owner or its designee shall have the right but not the obligation to suspend Work in the unsafe area. Contractor shall be liable for all costs incurred of any nature (including without limitation overtime pay, liquidated damages or other costs resulting from delays) resulting from the suspension.
- .4 **Right of Owner to have Contractor Send Worker Home:** The Contractor shall provide to each worker on the job site the proper safety equipment for the duties being performed by that worker and will not permit any worker on the job site who fails or refuses to use the same. The Owner shall have the right but not the obligation to order the Contractor to cause any worker to be sent home for the day or to otherwise temporarily or permanently remove him or her from the job site for his or her failure to comply with safe practices or anti-substance abuse policies. Contractor shall promptly comply with such orders from the Owner and shall be liable for any and all costs of whatsoever nature, including attorney's fees paid or incurred by the Owner.

**§ 10.1.3 Protection of Work and Property; Responsibility for Loss:** The Contractor shall, throughout its performance of the Work, maintain adequate and continuous protection of all property of the Owner and third parties and of the Work and temporary facilities against loss or damage from whatever cause arising out of the performance of the Work and shall comply with the requirements of the Owner and its insurance carriers and with all applicable laws, codes, rules and regulations with respect to the prevention of loss or damage to property as a result of fire or other hazards.

**§ 10.1.4 Emergencies:** In any emergency affecting the safety of persons or property, or in the event of a claimed violation of any federal or state safety or health law or regulation arising out of or in any way connected with the Work or its performance, the Contractor shall act immediately to prevent threatened damage injury or loss or to remedy said violation whichever is applicable, failing which the Owner or its Designee may immediately take whatever action it deems necessary including, but not limited to, suspending the Work.

The Owner may offset any and all cost or expenses of whatever nature including attorneys' fees paid or incurred by the Owner in taking such action against any sums then or thereafter due to the Contractor. The Contractor shall defend indemnify and hold the Owner, and its officers, agents, employees, harmless against any and all costs, expenses or liability in accordance with Section 3.1.8. If the Contractor shall be entitled to any additional compensation or extension of time claimed on account of emergency work not due to the fault or neglect of the Contractor or its Subcontractors or Sub-subcontractors, it shall be handled as a request for a Change Order as provided in Section 7.2 of this Contract.

## § 10.2 SAFETY OF PERSONS AND PROPERTY

**§ 10.2.1** The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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The Contractor shall provide and pay for whatever security measures the Contractor deems necessary to protect the Contractor's work until acceptance by the Owner through issuance of a Certificate of Substantial Completion.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 At a minimum, the Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities. Additionally, the Contractor shall maintain all passageways, guard fences, lights and other facilities for protection.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor, at a minimum, shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

- .1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the Owner advance written notice of at least five (5) days prior to bringing to the site or utilizing such explosives, materials, equipment or methods..

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 and indemnify and save the Owner harmless for all damage or injury to referenced persons and property caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable in whole or in part to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

- .1 The Contractor shall repair or replace any such damage at no additional cost to the Owner. Such repair or replacement shall be completed within one week of the damage or as directed by the Owner Representative. If the Contractor fails or refuses to repair the damage promptly, the Owner may have the necessary Work performed and charge the cost to the Contractor.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger the safety of persons or property or cause damage or create an unsafe condition.

*(Paragraphs deleted)*

§ 10.2.8 All materials furnished and all work installed shall comply with the rules and recommendations of the National Board of Fire Underwriters; with all applicable State and local codes, laws, ordinances, rules and regulations; with all requirements of local utility companies and with the recommendations of the Insurance Rating Organization having jurisdiction.

§ 10.2.9 All apparatus, equipment and construction such as ladders, scaffolds, chutes, etc. shall comply with the recommendations of the manual of Accident Prevention in Construction published by the Associated General Contractors of America.

### § 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the

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Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.1.1 Upon request, the Owner, through the Office of Environmental Health and Safety, will provide the Contractor with a written copy of the Hazard Communication Program and chemical inventory for work areas in which they will be working. The Owner, upon request, will make available to the Contractor an opportunity to review the Material Safety Data Sheets ("MSDS") on file for areas where hazardous chemicals are used and stored for work areas they will be working in.

§ 10.3.1.2 Per OSHA's Hazard Communication Standard, Contractors are expected to inform and provide the Owner any MSDSs of materials to be used in their work at the University of Connecticut. Contractors shall provide a chemical inventory and information on the location of chemical use and storage. The Contractor shall be responsible for the removal of all unused portions of chemicals and their waste products from the Project Site. A copy of the Hazard Communication Policy is available for review by the Contractor or prospective Proposers of the Contract at the Office of Capital Project & Contract Administration or at:

<http://www.ehs.uconn.edu/Occupational/occuhazard.php>

or <http://ors.uchc.edu>

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Upon written request, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up which may have occurred, but must be demonstrated as impacting the critical path of the schedule.

§ 10.3.3 NOT USED.

§ 10.3.4 In no event, however, shall the Owner have any responsibility for any substance or material that is brought to the Project site by the Contractor, any Subcontractor, any materialman or supplier or any entity for whom any of them is responsible. The Contractor agrees not to use any fills or other materials to be incorporated into the Work, which are hazardous, toxic or comprised of any items that are hazardous or toxic. In the event it is determined materials that are hazardous, toxic or comprised of items that are hazardous or toxic have been used as fills or incorporated into the Work, the Contractor, at its sole expense, shall be responsible for immediate removal, proper disposal, and replacement of materials of the Work and surrounding areas so affected.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 Contractor shall verify that all material/equipment installed in any portion of the Work shall be asbestos free. The Owner may perform sampling to verify all suspect material/equipment is asbestos free. If any material/equipment is found to contain asbestos, the Contractor shall pay for the lawful and proper removal and disposal of product(s), and re-install acceptable material/equipment all at its sole expense. Contractor shall visually and in writing provide to Owner or its representative proof that products or equipment to be used are non-asbestos containing, asbestos free, do not contain asbestos, or similar via manufacture statement on product itself or accompanying information.

**10.3.6.1** For purposes of this requirement, materials include, but are not limited to, the following:

**.1 Surfacing Treatments**

Fireproofing Acoustical Plaster  
Finish Plasters, Skim Coats of Joint Compound, Fibrous Type Paint Applications

**.2 Thermal System Insulation**

Equipment Insulation  
Boiler, Breeching, Boiler Rope, Duct or Tank Insulation, Cement or Mortar used for boilers and refractory brick  
Piping and fitting insulations including but not limited to Wrapped Paper, Aircell, Millboard, Rope, Cork, Preformed Plaster, Job Molded Plaster and coverings over fibrous glass insulation

**.3 Roofing and Siding Miscellaneous Materials**

Insulation Board Vapor Barriers  
Coatings Felts  
Flashing Shingles  
Cementitious Board (Transite) Galbestos  
Non-Metallic or Non-Wood roof Decking

**.4 Other Miscellaneous Materials**

Cove Base Floor Leveling Compound  
Ceiling Tile Vermiculite Insulation  
Vibration Isolators Laboratory Tables and Hoods

§ 10.3.7 Most buildings at the University of Connecticut have some Asbestos Containing Materials (ACM) used as building products. Any known ACM has been identified on the Plans and Specifications of this Contract.

§ 10.3.8 Every effort has been made to identify ACM; however, there may be additional ACM present in the area of work. This suspected ACM may become apparent especially during the demolition phases of contracts.

§ 10.3.9 The Contractor shall make every attempt to accomplish work in such a manner as to not disturb ACM or suspected ACM. If the Work cannot be accomplished without disturbing ACM or suspected ACM, or if ACM abatement is specifically incorporated as part of this contract, the Contractor must have the applicable training, licenses, or any other qualifications necessary to perform such work safely and in accordance with Federal, State and Local regulations.

§ 10.3.10 The Contractor shall bring to the immediate attention of the Owner Representative the location of suspected ACM that will be disturbed by work required under this Contract. No work shall be attempted that could result in a release of ACM to the environment.

§ 10.3.11 Asbestos surveys for most buildings of the Owner which are part of this Contract are available for Contractor's review in the Architectural and Engineering Services building or for UCHC projects at the Facilities Development & Operations office.

§10.3.12 Exposure levels for lead in the construction industry are regulated by 29 CFR 1926.62. Construction activities disturbing surfaces containing lead-based paint (LBP) which are likely to be employed, such as sanding, grinding, welding, cutting and burning, have been known to expose workers to levels of lead in excess of the Permissible Exposure Limit (PEL). Contractor shall conduct demolition and removal work specified in the Contract Documents in conformance with these regulations. In addition, construction debris/waste may be classified as hazardous waste. Disposal of hazardous waste material shall be in accordance with 40 CFR Parts 260 through 271 and Connecticut Hazardous Waste Management Regulations Section 22a-209-1; 22a-209-8(c)-11; and 22a-449(c)-100 through 110.

§ 10.3.13 Where a child under the age of six resides, the work shall also be in accordance with Connecticut Regulations Section 19a-111-1 through 11.

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**§ 10.3.14** If this is a renovation project, testing for lead-based paint has been conducted at selected facilities of the Owner. Results of LBP testing are for information purposes only. Under no circumstance shall this information be the sole means used by the Contractor for determining the extent of LBP. The Contractor shall be responsible for verification of all field conditions affecting performance of the Work.

**§ 10.3.15** Except for UCHC projects, lead based paint testing results are available at the Architectural and Engineering Services building. Contractors proposing on this project are requested to visit this office and review lead testing documents.

#### **§ 10.4 EMERGENCIES**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

#### **10.5 LOCKOUT/TAGOUT PROCEDURES REQUIRED BY OSHA**

**§ 10.5.1** OSHA regulations 29 CFR 1910.147 (The Control of Hazardous Energy) requires employers to develop procedures for the lockout or tag out of machines or equipment. The purpose is to prevent injuries by ensuring that hazardous forms of energy are isolated (locked or tagged out) before employees perform any servicing or maintenance activities, which could result in the unexpected energization, start-up or release of stored energy. This includes electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy sources.

**§ 10.5.2** The Owner has a written Lockout/Tag out Policy, as required under 29 CFR 1910.147. The policy is available for review by the Contractor or prospective Proposers of this Contract upon request.

**§ 10.5.3** Prior to commencing any work under this Contract that will or may involve exposure to potentially hazardous energy; the Contractor shall notify the Owner Representative of the lockout/tag out procedures to be used. Lockout/tag out procedures shall be exchanged between the Contractor and the Owner Representative at the Pre-Construction Conference.

**§ 10.5.4** All work carried out under this Contract that will or may involve exposure to potentially hazardous energy shall be carried out in accordance with all applicable Federal, State and local rules and regulations, including OSHA regulation 29 CFR 1910.147 (The Control of Hazardous Energy) and 1926.417 (Locking and Tagging of Circuits).

#### **10.6 SOLVENT BASED PRODUCTS**

**§ 10.6.1** The use of solvent-based products, including paints and adhesives within occupied areas of buildings shall not be allowed as part of this project, unless specifically directed in other provisions of the Contract Documents. The use of solvent-based products in non-occupied areas shall be carried out using adequate ventilation that prevents migration of vapors into occupied areas. If solvent-based products are to be used in occupied areas, then work shall only be accomplished on nights or weekends and with prior approval with the Owner Representative; continuous ventilation should be provided as required to mitigate odors on building occupants using adequate ventilation. The Contractor's representative shall notify the Owner Representative, the Department of Environmental Health and Safety and the Building Safety Committee Representative two (2) days prior to the intended date of such work.

#### **10.7 CONFINED SPACE ENTRY**

**§ 10.7.1** Certain areas at the University of Connecticut such as manholes, tanks, vessels, trenches, ducts, etc. meet the OSHA definition of a confined space (pursuant to 29 CFR 1910.146) in that they: 1) are large enough and so configured that an employee can bodily enter and perform assigned work; 2) have limited or restricted means for entry or exit; and 3) are not designated for continuous employee occupancy.

**§ 10.7.2** According to this OSHA regulation, employers are required to implement a confined space entry permit program if its employees will enter confined spaces which have one or more of the following characteristics: 1) contain or have the potential to contain a hazardous atmosphere, 2) contain a material that has the potential for engulfing and entrant, 3) have an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or by a floor which slopes downward and tapers to a smaller cross-section, or 4) contain any other recognized safety or health hazard. Such a space is considered to be a permit-required confined space.

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§ 10.7.3 The Owner has a written confined space entry policy, which implements a permit program. The policy is available for review by the Contractor or prospective Proposers of this Contract at the Architectural and Engineering Services building.

§ 10.7.4 Prior to commencing work that may require entry into a confined space; the Contractor shall consult with the Owner Representative and the Environmental Health and Safety Department to become apprised of the locations, the nature of the hazards, and safe entry procedures of known permit-required confined spaces.

§ 10.7.5 The contractor shall coordinate entry operations with the Owner through the Owner Representative when both Owner and Contractor personnel will be working in or near permit spaces.

§ 10.7.6 Any work carried out under this Contract that will require entry into a confined space shall be carried out in accordance with all applicable Federal, State, and Local rules and regulations, including OSHA regulations 29 CFR 1910.146 (Permit required confined spaces), 1926.21(b) (6) (Safety Training and Education – Employer responsibility (confined spaces)), 1926.352(g) (Fire prevention in enclosed spaces) and 1926.353(b) (Welding, cutting and heating in confined spaces).

#### **10.8 EXCAVATION AND TRENCHING**

§ 10.8.1 The Owner has a written Excavation and Trenching Policy, which can be found in the Owner's Contractor Environmental Health and Safety Manual.

§ 10.8.2 Any work carried out under this Contract that will require excavation or trenching shall be carried out in accordance with all applicable Federal, State and Local rules and regulations, including OSHA regulation 29 CFR 1926 Subpart P (Excavations).

§ 10.8.3 At a minimum, the Contractor shall comply with established Owner's Contractor Environmental Health and Safety Manual, which have been previously provided to bidders and/or are available for review upon request. These policies are hereby incorporated by reference herein, including but not limited to: Policies on Lockout/Tagout; Confine Space Entry; Code of Conduct; Sexual Harassment; Racism and Acts of Intolerance; Smoking.

#### **ARTICLE 11 INSURANCE AND BONDS**

##### **§ 11.1 CONTRACTOR'S LIABILITY INSURANCE**

§ 11.1.1 The Contractor shall demonstrate and provide evidence of insurance in an industry accepted certificate of insurance and maintain with a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect

to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

- .1 **Worker's Compensation Insurance:** Worker's Compensation Insurance in Statutory Limits of the Worker's Compensation Laws of the State of Connecticut, and other extensions, with Coverage B – Employer's Liability of not less than limits of \$1,000,000 – Each Accident, \$1,000,000 – Policy Limit and \$1,000,000 – Each Employee. Coverage under the Broad Form All State extension shall also be included.
- .2 **Commercial General Liability Insurance:** \$1,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage. Coverage shall include Premises and Operations, Independent Contractors, Products and Completed Operations, Contractual Liability and Broad Form Property Damage coverage. If a general aggregate is used, the general aggregate limit shall apply separately to the project or the general aggregate limit shall be twice the occurrence limit. The coverage shall contain no special limitations on the scope of protection afforded to the State. Said policy shall also state that it is primary insurance, and that the Owner, the State of Connecticut, the Contractor, and such other persons or interests as the Owner may designate as additional insured in connection with the performance of the Work, including hazards of operations (including explosion, collapse and underground coverage), elevators, independent contractors, employees as additional insured, completed operations for a period of three (3) years after final completion of the Work.
- .3 **Automobile Liability Insurance:** Automobile Liability Insurance covering all owned, non-owned and hired automobiles, trucks and trailers of the respective parties required to provide and maintain this insurance. Such insurance shall provide coverage not less than that of the Standard Comprehensive Automobile Liability policy in limits not less than, as respects Contractor and all tiers of Subcontractors, \$1,000,000 Combined Single Limit each occurrence for Bodily Injury and Property Damage.
- .4 **Umbrella Liability Insurance:** Umbrella liability (following form) in the amount of \$5,000,000 per Occurrence.
- .5 **Aircraft Liability:** If aircraft of any kind is used by the Contractor, any tier of Subcontractor or by anyone else on their behalf, the Contractor or Subcontractor shall maintain or cause the operator of the aircraft to maintain aircraft public liability insurance insuring passengers and the general public against personal injury, bodily injury or property damage arising from aircraft owned, used, operated or hired in connection with the Work by the Contractor, Subcontractor or anyone else in limits of \$50,000,000 Combined Single Limit for any one occurrence, each aircraft.
- .6 **Contractor's Pollution Liability:** If the work of this project includes the abatement, removal, cleanup or handling of any asbestos, PCB's, lead based paint, or other pollutants or hazardous materials, then the Contractor shall also provide evidence that Pollution Liability Insurance, including completed operations and Contractual Liability coverage of not less than limits of \$5,000,000 has been procured and is in force on the project. However, if the Contractor demonstrates that coverage for claims arising out of the abatement, removal, cleanup or other handling of asbestos, PCB's, lead based paint, or other pollutants or hazardous materials is covered by the Contractor's general liability insurance, a separate Contractor's Pollution Liability Policy will not be required.
- .7 **Builder's Risk:** If the Project is for new construction, rather than for renovations to an existing structure or facilities, the Contractor shall purchase and maintain Builder's Risk Insurance, ISO CP 30 10 00 special form, in the amount of the initial contract amount plus values of subsequent modifications or change orders on a replacement cost basis. The Builder's Risk coverage shall be written on a Special Covered Cause of Loss form and shall include theft, vandalism, malicious mischief, collapse, temporary buildings, transit, debris removal, increased cost of construction, architect fees and expenses, soft costs, flood and earthquake. Builder's Risk shall include portions of work located away from site but intended for use at the site. Contractor shall obtain consent of the insurance company and delete any provisions with regard to restrictions within any occupancy clause. Equipment break down coverage shall be included and shall cover insured equipment during installation and testing.
- .8 It is agreed that the Owner, the State of Connecticut, their officers, officials, agents, employees, boards and commissions shall be additional named insureds under the coverages described in Clauses 11.1.2.2; 11.1.2.3; 11.1.2.4; 11.1.2.5; 11.1.2.6; 11.1.2.7 and that said coverage(s) is provided for all operations, uses, occupations, acts and activities of the insureds under the Contract Documents and under any amendments, modifications, extensions or renewals of said Contracts regardless of whether liability is

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attributable to the named insureds or a combination of the named insureds and the additional named insureds.

- .9 If the Contractor is a joint venture, the joint venture and each individual partner of the joint venture must be designated in each policy as named insureds.
- .10 A Certificate of Insurance shall clearly indicate the Project name, Project number or some easily identifiable reference to the relationship to the Owner.
- .11 Each liability policy shall contain a Cross Liability Endorsement.
- .12 Coverage, written on an occurrence basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.
- .13 All insurance secured by Contractor or Subcontractors pursuant to the Owner's requirements under the provisions of this Section 11.1.2 shall be in policies subject to the Owner's approval, as to form, content, limits of liability, cost and issuing companies. Such companies shall have and maintain an A.M. Best rating of not less than A-(VII), or otherwise acceptable to Owner.
- .14 If the Contractor maintains insurance against physical loss or damage to Contractor's construction equipment and tools, such insurance shall include an insurer's waiver of rights of subrogation in favor of Owner.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled, terminated or materially changed, altered or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief and shall identify on their faces the project name and contract number to which they apply. The Certificate(s) of Insurance must also provide clear evidence that the Contractor's Insurance Policies contain at least the minimum limits of coverage and special provisions prescribed in Article 11.

§ 11.1.4 Form Certificates acceptable by the Owner shall be Accord 25(2001/08) together with Endorsement CG 20 37 07 04.

§ 11.1.5 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

## § 11.2 OWNER'S LIABILITY INSURANCE NOT USED.

## § 11.3 PROPERTY INSURANCE

§ 11.3.1 Property insurance on an all-risk basis, including coverage for the perils of earthquakes and floods, has been purchased by the Owner. Insurance required by Section 11.3 is not intended to cover machinery, tools and equipment of the Contractor which is used in the performance of the Work, but is not incorporated into the permanent improvements, nor any materials and equipment paid for by the Owner and stored off-site, for which the Contractor shall procure property insurance satisfactory to the Owner. The Contractor shall, at its own expense, provide coverage for its machinery, tools and equipment subject to these provisions.

§ 11.3.1.1 NOT USED.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then procure and maintain insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be

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charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the Owner's property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

§ 11.3.1.4 NOT USED.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

#### § 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE  
NOT USED.

§ 11.3.4 NOT USED.

§ 11.3.5 NOT USED.

§ 11.3.6 NOT USED.

#### § 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights of subrogation against (1) each other and any of their subcontractors of all tiers, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors of all tiers, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3, the boiler and machinery insurance maintained by the Owner or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Contract between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of

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damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five (5) days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Contract. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

#### § 11.4 PERFORMANCE BOND; PAYMENT BOND AND GUARANTY/CASHBOND

§ 11.4.1 The Contractor shall furnish to the Owner and deliver at the time of contract signing Performance and Payment Bonds pursuant to the requirements of Connecticut General Statutes Section 49-41 et seq. and the requirements of this Section 11.4. In all cases where the Contract Sum exceeds \$100,000, the Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Each such Bond shall be in compliance with the form which has been adopted by the Owner as its required form of payment or performance bond and shall be provided by a Surety company licensed to do business in the State of Connecticut and that is acceptable to the Owner, and is named in the current list of "Surety Companies Acceptable on Federal Bonds" as published in the "Treasury Department Circular 570". The Surety company's underwriting limitation, as further set forth in "Treasury Department Circular 570", must not be less than the full amount required by the bond itself. The amount of each bond shall be equal to One Hundred Percent (100%) of the Contract Sum. The Payment and Performance Bonds shall name as "Obligee" the University of Connecticut.

§ 11.4.1.1 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.4.1.2 Each surety bond and surety contract between the Contractor named as a principal on the bond and the surety that issued the bond shall contain the following language: "In the event that the surety assumes the contract or obtains a bid or bids for completion of the contract, the surety shall ensure that the contractor chosen to complete the contract is prequalified pursuant to section 4a-100 of the Connecticut General Statutes in the requisite classification and has the aggregate work capacity rating and single project limit necessary to complete the contract.

§ 11.4.2 If the Contractor or any of its subcontractors is a non-resident contractor, the Contractor and/or subcontractor shall comply with the requirements of Connecticut General Statutes Section 12-430(7) ("the statute"), to the extent applicable. If the Contractor is a verified contractor as defined in the statute, the Contractor shall provide to the Owner written verification of that status from the State Commissioner of Revenue Services. If the Contractor is an unverified contractor as defined in the statute, the Contractor shall provide to the Owner proof that the Contractor has posted with the Commissioner of Revenue Services a surety bond in an amount equal to five percent (5%) of the contract price and which is otherwise in compliance with the requirements of the statute.

§ 11.4.3 If the Contractor proposes a Subcontractor default coverage program, the Contractor must demonstrate a cost savings of no less than 18% as compared to the actual Subcontractor traditional bond cost, including a reasonable percentage for changes as agreed upon by the Owner.

#### ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

##### § 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Owner Representative with the advice of the Architect has not specifically requested to examine prior to its being covered, the Owner Representative with the advice of the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of

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correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

## **§ 12.2 CORRECTION OF WORK**

### **§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION**

The Contractor shall promptly correct Work rejected by the Owner Representative with the advice of the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing, inspections, uncovering and replacement, and compensation for the Architect's and Owner Representative services made necessary thereby, shall be at the Contractor's expense.

If prior to the date of Substantial Completion, the Contractor, a Subcontractor or anyone from whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

### **§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly at Contractor's sole expense after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4 or may exercise any other commercially reasonable remedies to compensate Owner for any expenses losses or damage caused by such nonconforming work.

**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

## **§ 12.3 ACCEPTANCE OF NONCONFORMING WORK**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

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## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located.

### § 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### § 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### § 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

### § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made at an appropriate time as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities having jurisdiction. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's and Owner Representative services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

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§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST  
NOT USED.

§ 13.7 TIME LIMITS ON CLAIMS  
NOT USED.

**§ 13.8 NON-DISCRIMINATION, AFFIRMATIVE ACTION, GOVERNOR'S EXECUTIVE ORDERS, AND OTHER MISCELLANEOUS PROVISIONS**

§ 13.8.1 NONDISCRIMINATION. References in this section to "Contract" shall mean this Contract and references to "Contractor" shall mean the Contractor.

(a) For purposes of this Section, the following terms are defined as follows: (i) "Commission" means the Commission on Human Rights and Opportunities; (ii) "Contract" and "contract" include any extension or modification of the Contract or contract; (iii) "Contractor" and "contractor" include any successors or assigns of the Contractor or contractor; (iv) "Gender identity or expression" means a person's gender-related identity, appearance or behavior, whether or not that gender-related identity, appearance or behavior is different from that traditionally associated with the person's physiology or assigned sex at birth, which gender-related identity can be shown by providing evidence including, but not limited to, medical history, care or treatment of the gender-related identity, consistent and uniform assertion of the gender-related identity or any other evidence that the gender-related identity is sincerely held, part of a person's core identity or not being asserted for an improper purpose; (v) "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations; (vi) "good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements; (vii) "marital status" means being single, married as recognized by the State of Connecticut, widowed, separated or divorced; (viii) "mental disability" means one or more mental disorders, as defined in the most recent edition of the American Psychiatric Association's "Diagnostic and Statistical Manual of Mental Disorders", or a record of or regarding a person as having one or more such disorders; (ix) "minority business enterprise" means any small contractor or supplier of materials fifty-one percent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise, and (3) who are members of a minority, as such term is defined in subsection (a) of Connecticut General Statutes § 32-9n; and (x) "public works contract" means any agreement between any individual, firm or corporation and the State or any political subdivision of the State other than a municipality for construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, or which is financed in whole or in part by the State, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

For purposes of this Section, the terms "Contract" and "contract" do not include a contract where each contractor is (1) a political subdivision of the state, including, but not limited to, a municipality, (2) a quasi-public agency, as defined in Conn. Gen. Stat. Section 1-120, (3) any other state, including but not limited to any federally recognized Indian tribal governments, as defined in Conn. Gen. Stat. Section 1-267, (4) the federal government, (5) a foreign government, or (6) an agency of a subdivision, agency, state or government described in the immediately preceding enumerated items (1), (2), (3), (4) or (5).

(b) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, mental retardation, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the State of Connecticut; and the Contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, mental

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retardation, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by the Contractor that such disability prevents performance of the work involved; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the Commission; (3) the Contractor agrees to provide each labor union or representative of workers with which the Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which the Contractor has a contract or understanding, a notice to be provided by the Commission, advising the labor union or workers' representative of the Contractor's commitments under this section and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor agrees to comply with each provision of this Section and Connecticut General Statutes §§ 46a-68e and 46a-68f and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes §§ 46a-56, 46a-68e and 46a-68f; and (5) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor as relate to the provisions of this Section and Connecticut General Statutes § 46a-56. If the contract is a public works contract, the Contractor agrees and warrants that he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works projects.

(c) Determination of the Contractor's good faith efforts shall include, but shall not be limited to, the following factors: The Contractor's employment and subcontracting policies and practices; affirmative advertising, recruitment and training; technical assistance activities and such other reasonable activities or efforts as the Commission may prescribe that are designed to ensure the participation of minority business enterprises in public works projects.

(d) The Contractor shall develop and maintain adequate documentation, in a manner prescribed by the Commission, of its good faith efforts.

(e) The Contractor shall include the provisions of subsection (b) of this Section in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes §46a-56; provided if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter.

(f) The Contractor agrees to comply with the regulations referred to in this Section as they exist on the date of this Contract and as they may be adopted or amended from time to time during the term of this Contract and any amendments thereto.

(g) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of sexual orientation, in any manner prohibited by the laws of the United States or the State of Connecticut, and that employees are treated when employed without regard to their sexual orientation; (2) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the Commission on Human Rights and Opportunities advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (3) the Contractor agrees to comply with each provision of this section and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes § 46a-56; and (4) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor which relate to the provisions of this Section and Connecticut General Statutes § 46a-56.

(h) The Contractor shall include the provisions of the foregoing paragraph in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a

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subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes § 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter.

§ 13.8.2 This Contract is subject to the provisions of **Executive Order No. 3 of Governor Thomas J. Meskill promulgated June 16, 1971**, concerning labor employment practices, **Executive Order No. Seventeen of Governor Thomas J. Meskill**, promulgated February 15, 1973, concerning the listing of openings and **Executive Order No. Sixteen of Governor John G. Rowland**, promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into and are made a party of this Contract as if they had been fully set forth herein. At the Contractor's request, the Owner shall provide a copy of these orders to the Contractor. The Contract may also be subject to **Executive Order No. 7C of Governor M. Jodi Rell**, promulgated July 13, 2006, concerning contracting reforms and **Executive Order No. 14 of Governor M. Jodi Rell**, promulgated April 17, 2006, concerning procurement of cleaning products and services, in accordance with their respective terms and conditions.

#### §13.8.3 ETHICS AND COMPLIANCE

In accordance with the Owner's compliance program, the Owner has in place an anonymous ethics and compliance reporting hotline service – 1-888-685-2637. Any person who is aware of unethical practices, fraud, violation of state laws or regulations or other concerns relating to Owner policies and procedures can report such matters anonymously. Such persons may also directly contact the Owner's compliance office at: Office of Audit, Compliance, and Ethics, 9 Walters Avenue, Unit 5084, Storrs, CT 06269-5084; Phone 860-486-4526; Fax 860-486-4527. As a provider of goods and/or services to the Owner, you are hereby required to notify your employees, as well as any subcontractors, who are involved in the implementation of this contract, of this reporting mechanism.

#### §13.8.4 CAMPAIGN CONTRIBUTION RESTRICTIONS

For all State contracts as defined in P.A. 10-1 having a value in a calendar year of \$50,000 or more or a combination or series of such agreements or contracts having a value of \$100,000 or more, the authorized signatory to this Contract expressly acknowledges receipt of the State Elections Enforcement Commission's notice advising state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice (SEEC Form 11) below:

**SEEC FORM 11**  
**CONNECTICUT STATE ELECTIONS ENFORCEMENT COMMISSION**  
Rev. 1/11

**NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND  
PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION  
AND SOLICITATION LIMITATIONS**

This notice is provided under the authority of Connecticut General Statutes §9-612(g)(2), as amended by P.A. 10-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on the reverse side of this page).

**CAMPAIGN CONTRIBUTION AND SOLICITATION  
LIMITATIONS**

*No state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor, with regard to a state contract or state contract solicitation with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee (which includes town committees).*

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution

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to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

On and after January 1, 2011, no state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor, with regard to a state contract or state contract solicitation with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall **knowingly solicit** contributions from the state contractor's or prospective state contractor's employees or from a *subcontractor or principals of the subcontractor* on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

### DUTY TO INFORM

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

### PENALTIES FOR VIOLATIONS

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

**Civil penalties**—Up to \$2,000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of up to \$2,000 or twice the amount of the prohibited contributions made by their principals.

**Criminal penalties**—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or not more than \$5,000 in fines, or both.

### CONTRACT CONSEQUENCES

In the case of a state contractor, contributions made or solicited in violation of the above prohibitions may result in the contract being voided.

In the case of a prospective state contractor, contributions made or solicited in violation of the above prohibitions shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State shall not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information may be found on the website of the State Elections Enforcement Commission, [www.ct.gov/seec](http://www.ct.gov/seec). Click on the link to "Lobbyist/Contractor Limitations."

### DEFINITIONS

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state

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contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract*, (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan, a loan to an individual for other than commercial purposes or any agreement or contract between the state or any state agency and the United States Department of the Navy or the United States Department of Defense.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

"Managerial or discretionary responsibilities with respect to a state contract" means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

"Dependent child" means a child residing in an individual's household who may legally be claimed as a dependent on the federal income tax of such individual.

"Solicit" means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

"Subcontractor" means any person, business entity or nonprofit organization that contracts to perform part or all of the obligations of a state contractor's state contract. Such person, business entity or nonprofit organization shall be deemed to be a subcontractor until December thirty first of the year in which the subcontract terminates. "Subcontractor" does not include (i) a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or (ii) an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a subcontractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a subcontractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a subcontractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a subcontractor, which is not a business entity, or if a subcontractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any subcontractor who has managerial or discretionary responsibilities with respect to a subcontract with a state contractor, (v) the spouse or a dependent child who is eighteen years of age or older of an individual

described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the subcontractor.

#### **§ 13.8.5 WHISTLEBLOWING:**

This Contract is subject to the provisions of § 4-61dd of the Connecticut General Statutes. In accordance with this statute, if an officer, employee or appointing authority of the Contractor takes or threatens to take any personnel action against any employee of the Contractor in retaliation for such employee's disclosure of information to any employee of the Contracting state or quasi-public agency or the Auditors of Public Accounts or the Attorney General under the provisions of subsection (a) of such statute, the Contractor shall be liable for a civil penalty of not more than five thousand dollars for each offense, up to a maximum of twenty per cent of the value of this Contract. Each violation shall be a separate and distinct offense and in the case of a continuing violation, each calendar day's continuance of the violation shall be deemed to be a separate and distinct offense. The Owner may request that the Attorney General bring a civil action in the Superior Court for the Judicial District of Hartford to seek imposition and recovery of such civil penalty. In accordance with subsection (f) of such statute, each large state Contractor, as defined in the statute, shall post a notice of the provisions of the statute relating to large state Contractors in a conspicuous place which is readily available for viewing by the employees of the Contractor.

#### **§ 13.8.6 COMPLIANCE WITH OWNER POLICIES AND GUIDELINES**

At a minimum, the Contractor shall comply with established Owner policies and guidelines, which have been previously provided to bidders and/or are available for review upon request. These policies are hereby incorporated by reference herein, including but not limited to: Policies on Lockout/Tagout; Confined Space Entry as referenced in the Contractor's Environmental Health and Safety Manual; Code of Conduct; Sexual Harassment; Racism and Acts of Intolerance; Smoking.

#### **§ 13.9 PREFERENCE IN EMPLOYMENT**

**§ 13.9.1** In the employment of labor to perform the work specified herein, preference shall be given to citizens of the United States, who are, and continuously for three months prior to the date hereof have been residents of the labor market areas, as established by the Labor Commissioner in which said work is to be done; and if no such qualified persons are available, then to citizens who have continuously resided in the county in which the work is to be performed for at least three months prior to the date hereof and then to citizens of the State who have continuously resided in the State at least three months prior to the date hereof. In no event shall said provisions be deemed to abrogate or supersede in any manner any provision regarding residence requirements contained in a Collective Bargaining Agreement to which the Contractor is a party.

#### **§ 13.10 MINIMUM WAGE RATES**

**§ 13.10.1** If this project involves new construction of a building or other structure or improvement and the total cost of all Work to be performed by Contractors and Subcontractors is \$400,000 or more or if the project involves remodeling, refurbishing, rehabilitation, alteration or repair of a building or other structure or improvement and such total cost is \$100,000 or more then:

- .1 The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund as defined in Subsection (i) of Section 31-53 of the Connecticut General Statutes shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such project is being constructed. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each payday.

**§ 13.10.2** The State of Connecticut Labor Department Wage Schedule where required shall be provided with these documents typically with the Bidding Documents, or will be incorporated in the Contract Documents as an Addendum. The Contractor agrees to accept the current prevailing wage scale as well as any annual adjustment to the prevailing wage scale as provided by the Connecticut Department of Labor. Wage Rates will be posted each July 1st on the Department of Labor's website: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us). Such prevailing wage adjustment will not be considered a basis for an annual contract amendment. The schedule is deemed to reflect customary or prevailing wages for this project and is hereby incorporated and made a part of the Contract Documents. Wage Rates shall be

paid pursuant to Sections 31-53 and 31-54 of the Connecticut General Statutes and any regulations issued there under.

#### **§ 13.11 HOURS OF LABOR PERMITTED**

**§ 13.11.1** Pursuant to Section 31-57 of the Connecticut General Statutes, no person shall be employed to work or be permitted to work more than eight hours in any day or more than forty hours in any week on any work provided for in the Contract. The operation of such limitation of hours of work may be suspended during an emergency upon the approval of the Owner Representative.

#### **§ 13.12 EXAMINING AND COPYING CONTRACTOR'S RECORDS**

**§ 13.12.1** The Contractor shall permit the Owner or its duly authorized representative to examine and copy books and records of the Contractor relative to charges for extra work, alleged breaches of contract, settlement of claims, or any other matter involving the Contractor's demand for added compensation from the Owner. The Contractor shall also permit such examination and copying of his records as the Owner may deem necessary, excepting papers and records preceding the execution of the Contract that are not a matter of record with the Owner, in order to determine that the Contractor has complied with all laws and regulations pertaining to the Contract, such as but not limited to Labor Compliance, Affirmative Action Program and Equal Employment Opportunity.

**§ 13.12.2** The Contractor further agrees that he shall keep all records relating to this Contract until the expiration of six (6) years after final payment under this Contract is made, or six (6) months after settlement of any disputes whichever may be later.

**§ 13.12.3** The Contractor further agrees that he and his Subcontractors shall permit the Owner, at its own expense, by its duly authorized representatives, to inspect and audit all their data, records and files pertaining to this Contract.

#### **§ 13.13 SYSTEM LAYOUT DRAWING**

**§ 13.13.1** System layouts indicated on the on the drawings are generally diagrammatic and locations and arrangements of items are approximate. Exact routing of conduit, wiring, location of fixtures, outlets, panels, piping, valves and all other equipment shall be governed by the structural conditions and obstructions. The entire layout shall be followed as closely as possible and the right is reserved by the Owner to reasonably change the locations to accommodate any conditions which may arise during the progress of the work without additional compensation to the Contractors.

#### **§ 13.14 GUARANTY OF PERFORMANCE**

**§ 13.14.1** If the Contractor has submitted the financial statement of a parent or other affiliated entity in its Proposers Qualification Statement, or if pre-qualified, its application for pre-qualification and has also indicated in that submission that such parent or affiliate will guarantee the performance of the Contract, then the parent or affiliate shall execute, simultaneously, with the Contractor's execution of the Contract, a Guaranty in a form provided by and acceptable to the Owner.

#### **§13.15 JOINT VENTURE**

**§ 13.15.1** If the Contractor is a joint venture, each joint venture partner shall be jointly, severally and individually responsible to the Owner for the performance of any and all obligations of the Contractor encompassed by this contract or as required by applicable law, and each joint venture partner shall be jointly, severally and individually liable to the Owner for any failures to perform such obligations in accordance with the contract or applicable law. In its dealings with the Owner, each joint venture partner shall have full authority to act in behalf of and bind the joint venture and any other joint venture partner. Each joint venture partner shall be considered to be the agent of the joint venture and of any other joint venture partner.

### **ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT**

#### **§ 14.1 TERMINATION BY THE CONTRACTOR**

**§ 14.1.1** The Contractor may terminate the Contract if the Work is stopped for a period of sixty (60) consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped; or

- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped.
- .3 Not Used.
- .4 Not Used.

§ 14.1.2 Not Used.

§ 14.1.3 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon seven (7) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery.

§ 14.1.4 If the Work is stopped for a period of sixty (60) consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven (7) additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may, without prejudice to or waiving any other right or remedy of the Owner, terminate the Contract if the Contractor

- .1 refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents;
- .5 Fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all requirements of the Contract Documents;
- .6 Refuses or fails to prosecute the Work or any separable part, with the diligence that will insure its completion within the time specified in this Contract including any duly authorized extension, or fails to compete the Work within said period; or
- .7 Fails to comply with laws, rules, regulations, or directives regarding job site safety; or to comply with the provisions of the Owner's Contractor Environmental Health and Safety Manual, or orders or directives regarding safety issued by the Owner pursuant to the Contract.

§ 14.2.2 When any of the above reasons exist, the Owner, with advice of the Architect and upon certification by the Initial Decision Maker, determines that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4;
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work; and
- .4 Terminate the Contractor's right to proceed with a separate part of the Work if the Owner so elects.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be retained by the Owner. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect and Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

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**§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

**§ 14.3.1** The Owner may, without cause and without prejudice to or waiving any other right or remedy of the Owner, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

**§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

**§ 14.4.1** The Owner may, at any time, without prejudice or waiving any other right or remedy of the Owner, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this Section shall be by a Notice of Termination delivered to the Contractor specifying the extent of termination and the effective date.

**§ 14.4.2** Upon receipt of a Notice of Termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Section:

- .1 Cease operations as specified in the notice;
- .2 Place no further orders and enter into no further Subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.
- .4 Proceed to complete the performance of Work not terminated;
- .5 Take actions that may be necessary or that the Owner may direct for the protection and preservation of the terminated Work.

**§ 14.4.3** Upon such termination, the Contractor shall recover as its sole remedy, payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely purchased or fabricated off the Project site, delivered and stored in accordance with the Owner's instructions plus demobilization costs. The Contractor hereby waives and forfeits all other claims for payment and damages, including without limitation, anticipated profits.

**§14.4.4** The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work; (2) claims which the Owner has against the Contractor under the Contract and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

**§14.4.5** The payment to the Contractor pursuant to this Section may not exceed the total Contract Price as reduced by:

- .1 The amount of payments previously made
- .2 The Contract price of work not terminated.

**ARTICLE 15 CLAIMS AND DISPUTES**

**§ 15.1 CLAIMS**

**§ 15.1.1 DEFINITION**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension or time, and/or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

#### § 15.1.2 NOTICE OF CLAIMS

Claims by the Contractor must be initiated by written notice to the Owner Representative as described in Section 1.1.1.1 and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by the Contractor must be initiated within twenty-one (21) days after occurrence of the event giving rise to such Claim or within fourteen (14) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims may also be reserved by the Contractor in writing within the time limits set forth in this Section 15.1.2. If a Claim is reserved, the Resolution of Claims and Disputes procedures described in Article 15 shall not commence until a written notice from the Contractor is received by the Owner Representative. No such claim shall be valid unless so made. Any notice of Claim or reservation of Claim must clearly identify the alleged cause and the nature of the Claim and include data and information then available to the claimant that will facilitate prompt verification and evaluation of the Claim.

#### § 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

#### § 15.1.4 CLAIMS FOR ADDITIONAL COST

§ 15.1.4.1 If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§15.1.4.2 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be made in accordance with the provisions of this Article 15.

#### § 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. No such claim shall be valid unless made in accordance with the provisions of this Article 15. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

#### § 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES NOT USED.

§ 15.1.7 **Injury or Damage to Person or Property.** If the Contractor suffers injury or damage to person or property because of an act or omission of the Owner Representative, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding twenty-one (21) days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 15.1.8 **Claims for Concealed or Unknown Conditions:** If, upon or subsequent to the Contractor's and its Subcontractors' site visits and performance of the tests, examinations and inspections required by Section 3.2.2, the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor will promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 5 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part

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of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different in the respects noted above and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. Any claim by the Contractor in opposition to such determination must be made within 21 days after the Architect has given notice of the recommendation. The Owner Representative will have the final authority to accept or reject the Architect's recommendations, which decision by the Owner Representative shall be subject to further proceedings pursuant to Article 15.

#### § 15.2 INITIAL DECISION

§ 15.2.1 Claims by the Contractor, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the AIA 101-2007 Section 6.1 of the Contract. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, regardless of (1) whether such matters relate to execution and progress of the Work, or (2) the extent to which the Work has been completed. The decision by the Initial Decision Maker in response to a Claim shall not be a condition precedent to arbitration or litigation in the event (1) the position of Initial Decision Maker is vacant, (2) the Contractor has not provided evidence or (3) the Initial Decision Maker has failed to take action required under Section 15.2.2 within thirty (30) days after the Claim is made.

§ 15.2.2 The Initial Decision Maker will review Claims by the Contractor and within thirty (30) days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims of the Contractor, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim of the Contractor or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.4.1 If a Claim of the Contractor has not been resolved after consideration of the foregoing, the Initial Decision Maker will render a written decision on the claim, including any change in the Contract Sum or Contract Time or both, which decision shall be final and binding but subject to meeting and mediation pursuant to Section 15.3 of this document and arbitration or litigation pursuant to Connecticut General Statutes Section 4-61 and Section 15.4 of this Contract to the extent applicable.

§ 15.2.5 NOT USED.

§ 15.2.6 NOT USED.

§ 15.2.6.1 NOT USED.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 NOT USED.

#### § 15.3 MEDIATION

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§ 15.3.1 Claims of the Contractor except those waived as provided for in Section 9.10.5 shall be submitted to the meeting and mediation process described in the Sections which follow, prior to and as a precondition to the Contractor pursuing any other available remedy. Claims by the Owner, at the option of the Owner, may be submitted to such meeting process and/or mediation process, and, in such event, Contractor shall be required to submit to and participate in such a meeting and/or mediation. The meeting shall be between the parties and attended by individuals with decision-making authority regarding the dispute, to attempt in good faith to negotiate a resolution of the dispute.

§ 15.3.2 The meeting referenced in Section 15.3.1 shall be held promptly, but not less than fourteen (14) calendar days after a party's request for the meeting. The Contractor shall not submit any claim to mediation in accordance with the provisions of Sections 15.3.1 through 15.3.6 until fourteen (14) calendar days after the date of the meeting.

§ 15.3.3 In connection with any such mediation, a request for mediation shall be made in writing, delivered to the other party to the Contract. The request may be made concurrently with the filing of applicable binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of sixty (60) calendar days from the date of filing, unless stayed for a different period of time by agreement of the parties or as modified by court order.

§ 15.3.4 The parties will jointly appoint a mutually acceptable mediator, seeking assistance in such regard from a mutually agreed upon dispute resolution entity if they have been unable to agree upon such appointment within twenty (20) calendar days from the submittal of the request for mediation. If the parties are unable to agree on the dispute resolution entity, the mediation shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of this Contract.

§ 15.3.5 The parties agree to participate in good faith in the mediation and negotiations related thereto for a period of sixty (60) calendar days from the date of submittal, or until the parties reach impasse as evidenced by a letter from a party to the mediator, whichever first occurs. If the parties are not successful in resolving the dispute through mediation, then the parties may pursue other legal remedies available to them.

§ 15.3.6 Should the Owner request, the Contractor agrees to participate as a party in any mediation proceeding between the Owner and the Architect or other Consultant for the Project in which construction deficiencies, contract breaches, or other alleged wrongful acts by the Contractor are alleged.

#### § 15.4 ARBITRATION OR LITIGATION OF CLAIMS

§ 15.4.1 NOT USED.

§ 15.4.1.1 NOT USED.

§ 15.4.2 NOT USED.

§ 15.4.3 NOT USED.

§ 15.4.4 Should the Owner have a claim against the Contractor, the parties agree that the Owner, whether or not it elects to proceed with the meeting process or mediation described in Section 15.3, shall have the option of either prosecuting the claim against the Contractor in an appropriate court of general jurisdiction, or by arbitrating the claim by filing a demand for arbitration pursuant to the rules of a dispute resolution entity agreed upon by the parties, except that if the parties cannot agree upon a dispute resolution entity, the rules of the American Arbitration Association shall apply.

§ 15.4.5 Should the Contractor have a claim against the Owner which has not been resolved by mediation or any other procedure set forth in this Contract, the Contractor's rights to assert its claim against the Owner shall be subject to the provisions of Connecticut General Statutes Section 4-61.

#### § 15.4.6 CONSOLIDATION OR JOINDER

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User Notes:

(1802979639)

§ 15.4.6.1 Should either the Contractor institute an arbitration to the extent authorized by Section 4-61 of the Connecticut General Statutes or the Owner institute an arbitration as set forth herein, the Contractor agrees that any such arbitration may be consolidated, at the Owner's discretion, with any arbitration proceeding involving the Owner and the Architect or other Consultant for the Project in which construction or design deficiencies, breaches of contract, or any other alleged wrongful acts by the Contractor or Architect are alleged.

§ 15.4.6.2 NOT USED.

§ 15.4.6.3 NOT USED.

Init.

This document acknowledging agreement to the General Conditions contained herein is entered into as of \_\_\_\_\_, 2012 and is executed in at least three originals, of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.

\_\_\_\_\_  
*OWNER (Signature)*

\_\_\_\_\_  
*CONTRACTOR (Signature)*

Executive VP for Administration & CFO

\_\_\_\_\_  
Duly Authorized: CGS §§ 10a-109d; 10a-109n

*(Printed name and title)*

\_\_\_\_\_  
*(Printed name and title)*

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

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

*(Paragraphs deleted)*

Init.

**CHW System Improvements  
Central Utility Plant**

# **PROJECT SPECIFICATIONS**

## **VOLUME I OF I**

**Bid Set  
May 01, 2014**

**Project # 901696**



**State of Connecticut**

**University of Connecticut  
Architectural and Engineering Services**

**Susan Herbst  
President**

**Prepared By:**

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## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Time of Completion.
5. Access to site and Contractor Parking.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Work Sequence.
10. Miscellaneous provisions.

- B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: CHW System Improvements - Central Utility Plant.

- B. Project Location: University of Connecticut, Storrs, CT.

- C. Owner: University of Connecticut.

1. Owner's Representative: Michael Rocchetti

- D. Engineer: RMF Engineering.

- E. Project Web Site: A project Web site administered by Engineer will be used for purposes of managing communication and documents during the construction stage.

1. Coordination: See Section 013100 "Project Management and Coordination." for requirements for administering and using the Project Web site.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Provide a steam turbine drive centrifugal chiller, associated pumps, cooling tower, and piping, electrical wiring and equipment and control system additions.
2. Removal of all debris caused by this Contract.
3. Protection for the public, building, grounds from damage during this contract is the responsibility of the Contractor for this project at all times.
4. Repair or replace landscaping including trees, shrubs or other planting disturbed during the Work of the contract with new to match existing, unless otherwise noted. Regrade and reseed any grass area damaged as a result of the Work. Repair any walkways or paved areas damaged as a result of the Work.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

#### 1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with contractors that may have been issued separate contract(s) to perform certain construction operations at the site prior to construction activity under this contract so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.6 TIME OF COMPLETION

A. Work required by the project shall commence immediately upon receipt of a Notice to Proceed. However, physical work on site may not commence sooner than **issuance of the Notice to Proceed.**

1. The successful bidder shall obtain the Certificate of Substantial Completion as defined in the Contract Documents within **18 months** of the Notice to Proceed.
2. Substantial Completion as defined in the Contract Documents must be achieved and evidenced by a Certificate of Substantial Completion no later than **18 months from the Notice to Proceed.**
3. Due to the nature of this institution, it is required that the academic schedule must be maintained. Contractor shall cooperate and coordinate with the University to assure that the academic schedule will be maintained.
4. No Work may be conducted during University exam periods without the written permission from the University Representative. Exam periods which may affect this project are scheduled per attached link: <http://www.registrar.uconn.edu/calendar.htm>

## 1.7 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated; allow for Owner occupancy and use by the public. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits: Confine construction operations to work and staging areas shown on plans.
  2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  3. Burial of Waste Materials: No not dispose of organic and hazardous material on site, either by burial or by burning.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
- D. Contractor's Parking: Contractors working for the University of Connecticut at the regional campus will work with the University Representative to determine where contractors are allowed to park during the course of the Project.
1. Construction vehicles may park within the fenced construction area. Personal vehicles are not considered construction vehicles.
  2. Restore all lawn, sidewalk, paved areas damaged by vehicles and or construction activities to their original condition.
  3. Contractors working for the University of Connecticut at Storrs Campus are required to obtain a parking permit through the Parking Services Office. For additional information please contact the Parking Services Office at 860-486-4930. **A two hundred dollar (\$200.00 – fee subject to change) annual fee will be charged per vehicle.** The Contractor is responsible for payment of all fees for parking permits. Parking fees may be prorated monthly.
    - a. The University will provide a maximum of three (3) contract parking places in the vicinity of the work. Additional parking required by the Contractor will be designated at a location specified by the Owner's Representative.
    - b. Construction vehicles are exempt from this requirement.
- E. Contractor shall restrict use of construction related trucks on local roads, such as Hillyndale, Eastwood and Westwood Road.

- F. Refer to Section 01-3300 Par 2.1.L Safety Plan for submittal requirements prior to site access.

#### 1.8 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
  - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

#### 1.9 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated. Permission must be requested and approved in writing to perform work outside the normal working hours or on a State Holiday.
  - 1. Early Morning Hours: Not permitted.
  - 2. Hours for Utility Shutdowns: Coordinate with Owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Obtain Owner Representative written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  - 1. Notify Owner Representative not less than two days in advance of proposed disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

- F. Controlled Substances: Use of tobacco products and other controlled substances is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for screening of Contractor personnel working on Project site.
  - 1. Maintain list of approved screened personnel with Owner's representative.
- I. In addition to reasons determined by the University, approval of deviations in work hours is dependent upon availability of University supervisory personnel.
  - 1. No person shall be employed to work or permitted to work more than eight hours in any day or more than forty hours in any week on any work provided for under this Contract. The observance of such limitations of hours of work may be suspended during an emergency, upon approval of the Executive Director of Architectural and Engineering Services.
- J. If the Contractor determines that work on this project must be performed during a time other than normal working hours of the University, costs for any premium time must be included in the Base Bid.
- K. No Work may be conducted during University exam periods without the written permission from the University Representative. Exam periods which may affect this project are scheduled per attached link: <http://www.registrar.uconn.edu/calendar.htm>

#### 1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

#### 1.11 WORK SEQUENCE

- A. The responsibility of phasing the Work falls entirely on the Contractor.

## 1.12 MISCELLANEOUS PROVISIONS

### A. Certifications

1. The Contractor, at completion of construction, shall provide to the University a “Certificate of Substantial Compliance” bearing original signatures of an officer of the company stating: “this is to CERTIFY that, in my professional opinion, the complete structure/renovations described above is in substantial compliance with the approved construction documents on file with the University of Connecticut. Minor deviations and special stipulations are noted below (if any)”
2. Prior to Owner’s approval and acceptance, mechanical and electrical systems shall be fully operational and tested.

### B. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and/or scheduled on Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

## SECTION 012100 - ALLOWANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.

#### 1.3 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

#### 1.4 COORDINATION

- A. Coordinate allowance items with other portions of the Work.

#### 1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

## 1.6 ADJUSTMENT OF ALLOWANCES

- A. Costs of services not required by the Contract Documents are not included in the allowance.
- B. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable.
  - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
  - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
  - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
  - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- C. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

## 1.7 ALLOWANCE CLOSE OUT

- A. Any unused portion of the allowance, whether it is lump sum, unit cost, or quantity allowance, shall be credited to the Owner. Any unused portion of the allowance shall be reviewed by the owner to determine the amount of credit, based on actual invoices, delivery slips, etc.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Include the sum of \$105,740.00 for controls by Array Systems, who will provide the following scope:
  - 1. Supply one (1) 14" chilled water control valve for installation and wiring by others.
  - 2. Supply one (1) 18" condenser water control valve to for installation and wiring by others.
  - 3. Supply one (1) dual channel flow meter for installation and wiring by others.
  - 4. Supply one (1) Rosemount CT-14 outlet temp transmitter for installation by others.
  - 5. Supply one (1) Rosemount pressure differential transmitter for installation by others.
  - 6. Provide I&C engineering and project submittal.
  - 7. Provide loop drawings.
  - 8. Perform I&C project management.
  - 9. Provide field coordination of electrical & mechanical contractors for I&C installation.
  - 10. Integrate new chiller control panel with existing plant control system.
  - 11. Provide connections to the existing chiller replacement control panels.
  - 12. Provide PLC, HMI and OSI-PI Historian programming.
  - 13. Start and commission new chiller, pumps and cooling tower, with assistance from the mechanical and electrical contractors.
  - 14. Provide as-built drawings and operation & maintenance manuals for control systems..

END OF SECTION 012100

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Division 01 Section "Allowances" for products selected under an allowance.
  - 2. Division 01 Section "Alternates" for products selected under an alternate.
  - 3. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
  - 4. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Requested substitution provides specified warranty.
    - c. Substitution request is fully documented and properly submitted.
    - d. Requested substitution will not adversely affect Contractor's construction schedule.
    - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - f. Requested substitution is compatible with other portions of the Work.
    - g. Requested substitution has been coordinated with other portions of the Work.
    - h. Requested substitution provides specified warranty.
    - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 012500

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

#### 1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue through the University Representative supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on **AIA Document G710, "Engineer's Supplemental Instructions"** or similar form.

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer or University Representative will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Engineer or University Representative are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

- finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- e. Quotation Form: Use forms acceptable to Engineer.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer or University Representative.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  7. Proposal Request Form: Use form acceptable to Engineer or University Representative.

#### 1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

#### 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Engineer or University Representative will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or similar form.

#### 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer or University Representative may issue a Construction Change Directive on AIA Document G714 or similar form. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012600

## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
  - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Engineer.
    - c. Engineer's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
    - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
  3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
  5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  6. Allowances: Provide a separate line item in the schedule of values for each allowance. Each allowance shall be broken down by materials and stratup, at a minimum.
  7. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract.
  8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
  9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
    - a. Each Change Order or Directive will be a new line item.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
  - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Engineer.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or similar form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  - 3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
  2. Electronic transfers are also acceptable (preferred).
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Submittal schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. Copies of building permits.
  8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  9. Initial progress report.
  10. Report of preconstruction conference.
- I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.

4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. Evidence that claims have been settled.
7. Final liquidated damages settlement statement. (***TO BE DISCUSSED WITH UCONN***)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012900

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

- 1. General coordination procedures.
- 2. Coordination drawings.
- 3. Requests for Information (RFIs).
- 4. Project Web site
- 5. Meetings.

- a. Pre-construction conference
- b. Pre-installation conference
- c. Progress meetings
- d. Coordination meetings

- B. Related Requirements:

- 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
- 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
- 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
- 4. Division 01 Section "General Commissioning Requirements" for coordinating the Work with Commissioning Authority.

#### 1.3 DEFINITIONS

- A. RFI: Request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use of CSI Form 1.5A is recommended. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including project manager, superintendent, safety engineer and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.
  2. The University requires as a minimum, the following Key Personnel be assigned to this project. Each position shall be a full-time individual, dedicated to the position listed.
    - a. Project Manager (on site a minimum of once a week)
    - b. Project Superintendent (on-site full time)
    - c. Safety Engineer (part time with a minimum of 2 site visits per week and mandatory during welding of any kind)
    - d. Project Engineer (Project specific)
  3. Each individual listed above shall have not less than five (5) years experience performing work of a similar nature to this project and in a comparable position to the position assigned on this project. Resumes will be required on all key personnel prior to acceptance. Removal of any personnel denoted as Key Personnel from the project will require Owner's prior approval.

#### 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Project closeout activities.
  - 7. Startup and adjustment of systems.
  
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed devices, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed

resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Upper/Lower Level: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as operators, valves, access doors, cleanouts and electrical distribution equipment.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
  - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."

- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format or portable Data File (PDF) format.
  3. Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Digital Data Software Program: Drawings are available in AutoCAD 3D.
    - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Engineer.

#### 1.7 REQUESTS FOR INFORMATION (RFIS)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Engineer.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Engineer.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow five (5) working days for Engineer's response for each RFI. RFIs received by Engineer after 2:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Engineer's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
  3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within five (5) days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly or as directed by Owner's representative. Use software log that is part of Project Web site. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Engineer.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Engineer's response was received.
- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven (7) days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.8 PROJECT WEB SITE

- A. Use Engineer's Newforma Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
1. Project directory.
  2. Meeting minutes.
  3. Contract modifications forms and logs.
  4. RFI forms and logs.
  5. Task and issue management.
  6. Photo documentation.
  7. Schedule and calendar management.
  8. Submittals forms and logs.
  9. Payment application forms.
  10. Reminder and tracking functions.

## 1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three (3) days of the meeting.
- B. Preconstruction Conference: The successful bidder shall attend a preconstruction conference and organizational meeting at the University of Connecticut Office of Architectural and Engineering Services, with the University Representative prior to any field work to review responsibilities and personnel assignments and to insure that Specifications, drawings and all conditions are understood to properly complete this Contract.
1. The meeting will be scheduled by the University Representative.
  2. Conduct the conference to review responsibilities and personnel assignments.
  3. Attendees: The Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  4. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.

- d. Labor Market Regulations.
  - e. Designation of key personnel and their duties.
  - f. Lines of communications and emergency phone numbers.
  - g. Procedures for processing field decisions and Change Orders.
  - h. Procedures for RFIs.
  - i. Procedures for testing and inspecting.
  - j. Procedures for processing Applications for Payment.
  - k. Distribution of the Contract Documents and correspondence.
  - l. Submittal procedures.
  - m. Preparation of record documents.
  - n. Use of the premises, including dust and noise control.
  - o. Parking and parking permits
  - p. Work restrictions including working hours.
  - q. Owner's occupancy requirements.
  - r. Responsibility for temporary facilities and controls.
  - s. Procedures for disruptions and shutdowns.
  - t. Construction waste management and recycling.
  - u. Parking availability.
  - v. Office, work, and storage areas.
  - w. Equipment deliveries and priorities.
  - x. First aid.
  - y. Unacceptable behavior
  - z. Security.
  - aa. Progress cleaning.
  - bb. Safety procedures, including the University's Hazard Communication Program and policies on pest control, asbestos, lead-based paints, lockout/tagout procedures, excavation and trenching, disposal of PCB containing light ballasts, use of solvents, solvent or epoxy based paints, confined space entries and use of open flames.
5. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of record documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Submittal of written warranties.
    - d. Requirements for preparing operations and maintenance data.

- e. Requirements for delivery of material samples, attic stock, and spare parts.
  - f. Requirements for demonstration and training.
  - g. Preparation of Contractor's punch list.
  - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - i. Responsibility for removing temporary facilities and controls.
  - j. Turnover for systems for Owner operation.
  - k. Start dates for warrantees.
- D. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Progress cleaning.
      - 10) Quality and work standards.
      - 11) Status of correction of deficient items.
      - 12) Field observations.
      - 13) Status of RFIs.
      - 14) Status of proposal requests.
      - 15) Pending changes.
      - 16) Status of Change Orders.
      - 17) Pending claims and disputes.
      - 18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Conduct Project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
  1. Attendees: Every party currently involved in coordination or planning for the construction activities involved. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Daily construction reports.
  - 3. Material location reports.
  - 4. Site condition reports.
- B. Related Requirements:
  - 1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
  - 2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label. Submit schedule to the University Representative within 20 calendar days after the Contract Award
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Daily Construction Reports: Submit at monthly intervals.
- E. Material Location Reports: Submit at monthly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.

#### 1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
  1. Review software limitations and content and format for reports.
  2. Verify availability of qualified personnel needed to develop and update schedule.
  3. Discuss constraints, including phasing work stages area separations interim milestones and Owner occupancy.
  4. Review delivery dates for Owner-furnished products.
  5. Review schedule for work of Owner's separate contracts.
  6. Review submittal requirements and procedures.
  7. Review time required for review of submittals and resubmittals.
  8. Review requirements for tests and inspections by independent testing and inspecting agencies.
  9. Review time required for Project closeout and Owner startup procedures.
  10. Review and finalize list of construction activities to be included in schedule.
  11. Review procedures for updating schedule.

#### 1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  1. Secure time commitments for performing critical elements of the Work from entities involved.
  2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final Completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    - a. Chiller
    - b. Tower
    - c. Pumps
    - d. VFC's
  3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 15 working days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Use of premises restrictions.
    - e. Seasonal variations.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

1. Owner operating of equipment.
  2. Commissioning complete.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

1. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
- a. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Accidents.
  8. Meetings and significant decisions.

9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. **Material Location Reports:** At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. **Site Condition Reports:** Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.4 SPECIAL REPORTS

- A. **General:** Submit special reports directly to Owner within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. **Reporting Unusual Events:** When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. **Contractor's Construction Schedule Updating:** At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.
6. Web-based construction photographic documentation.

- B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
4. Division 02 Section "Selective Demolition" for photographic documentation before selective demolition operations commence.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

- B. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:
  - a. Name of Project.

- b. Name of Engineer.
- c. Name of Contractor.
- d. Date photograph was taken.
- e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- f. Unique sequential identifier keyed to accompanying key plan.

#### 1.4 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

### PART 2 - PRODUCTS

#### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  1. Date and Time: Include date and time in file name for each image.
  2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Engineer.
- C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
  1. Flag construction limits before taking construction photographs.
  2. Take 20 photographs to show existing conditions adjacent to work areas before starting the Work.
- D. Periodic Construction Photographs: Take photographs before covering work. Select vantage points to show status of construction and progress since last photographs were taken.

- E. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Engineer will inform photographer of desired vantage points.

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals, including;
  - 1. Contractor's construction schedule
  - 2. Submittal schedule
  - 3. Shop Drawings
  - 4. Coordination Drawings and Layout
  - 5. Daily Construction Reports
  - 6. Product Data
  - 7. Samples
  - 8. Site Mobilization Plan
  - 9. Safety Plan
- B. Related Requirements:
  - 1. AIA Document A101 Contract Article 5 "Payments" for submitting Applications for Payment and the schedule of values.
  - 2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

#### 1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 3. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Engineer's final release or approval.
    - g. Scheduled date of fabrication.

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 10 days for review of each resubmittal.
- C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
  4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Engineer.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Names of subcontractor, manufacturer, and supplier.
    - g. Category and type of submittal.
    - h. Submittal purpose and description.
    - i. Specification Section number and title.
    - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Related physical samples submitted directly.

- n. Indication of full or partial submittal.
  - o. Transmittal number.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
- D. Options: Identify options requiring selection by Engineer.
- E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Transmit each submittal from Contractor to University Representative using a transmittal form.
- 1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
    - a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.

- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 00 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- S. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- T. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- U. Site Mobilization Plan
  - 1. Prior to the start of operations on the site, the Contractor shall submit to the University Representative, a Site Mobilization Plan which shall indicate pertinent dates and times,

logistics, traffic flow and compliance with the General Requirements to a level of detail commensurate with the complexity of the construction and the sensitivity of the Owner's ongoing activities on site.

V. Safety Plan

1. Prior to, and as a condition of mobilization on site, the Contractor shall submit a Safety Plan consisting of no less that the following information:
  - a. Material Safety Data Sheets for all potentially harmful substances.
  - b. A list of Contractor, Subcontractor, and University personnel to be notified in the event of an emergency.
  - c. A list of Contractor's personnel to be notified by the University in the event of an emergency during "off" hours.
  - d. Evacuation Plans.
  - e. Emergency medical procedures.
  - f. Locations of emergency medical equipment.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, design loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ENGINEER'S ACTION

- A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

END OF SECTION 013300

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
  - 1. Divisions 02 through 33 Sections for specific test and inspection requirements.

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

- C. **Product Testing:** Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- D. **Source Quality-Control Testing:** Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- E. **Field Quality-Control Testing:** Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- F. **Testing Agency:** An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- G. **Installer/Applicator/Erector:** Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- H. **Experienced:** When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

- A. **Referenced Standards:** If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Qualification Data:** For Contractor's quality-control personnel.

- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system or designated seismic system.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

#### 1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
  3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

#### 1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.

- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
  - 1. Name, address, and telephone number of factory-authorized service representative making report.
  - 2. Statement that equipment complies with requirements.
  - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 4. Statement whether conditions, products, and installation will affect warranty.
  - 5. Other required items indicated in individual Specification Sections.
  
- D. **Permits, Licenses, and Certificates:** For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.8 QUALITY ASSURANCE

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
  
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
  
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
  
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
  
- E. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. **NRTL:** A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. **NVLAP:** A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
  
- F. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- G. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

## 1.9 QUALITY CONTROL

- A. **Contractor Responsibilities:** Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
  - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
  - 3. Notify the University Representative and testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- C. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- D. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. **Testing Agency Responsibilities:** Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Engineer, University Representative, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owners Representative, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Engineer, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Engineer.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's and Owner Representative's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 014200 - REFERENCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Engineeural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 4. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 5. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org).
  - 6. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 7. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 8. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 9. AIA - American Institute of Engineers (The); [www.aia.org](http://www.aia.org).
  - 10. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 11. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 12. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 13. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 14. APA - Engineeural Precast Association; [www.archprecast.org](http://www.archprecast.org).
  - 15. API - American Petroleum Institute; [www.api.org](http://www.api.org).
  - 16. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 17. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
  - 18. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
  - 19. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
  - 20. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
  - 21. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
  - 22. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
  - 23. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
  - 24. ASTM - ASTM International; (American Society for Testing and Materials International); [www.astm.org](http://www.astm.org).
  - 25. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
  - 26. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
  - 27. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).

28. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
29. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
30. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
31. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
32. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
33. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
34. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
35. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
36. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
37. CSA - Canadian Standards Association; [www.csa.ca](http://www.csa.ca).
38. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
39. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
40. ECA - Electronic Components Association; [www.ec-central.org](http://www.ec-central.org).
41. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
42. EIA - Electronic Industries Alliance; (See TIA).
43. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
44. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
45. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
46. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
47. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
48. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
49. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
50. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
51. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
52. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
53. IAS - International Approval Services; (See CSA).
54. ICBO - International Conference of Building Officials; (See ICC).
55. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
56. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
57. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
58. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
59. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
60. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
61. IESNA - Illuminating Engineering Society of North America; (See IES).
62. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
63. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
64. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
65. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
66. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
67. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
68. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
69. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
70. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
71. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
72. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).

73. NAAMM - National Association of Engineerural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
74. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
75. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
76. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
77. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
78. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
79. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
80. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
81. NFPA - NFPA; (National Fire Protection Association); [www.nfpa.org](http://www.nfpa.org).
82. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
83. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
84. NSF - NSF International; (National Sanitation Foundation International); [www.nsf.org](http://www.nsf.org).
85. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
86. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
87. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
88. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
89. SAE - SAE International; (Society of Automotive Engineers); [www.sae.org](http://www.sae.org).
90. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
91. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
92. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
93. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
94. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
95. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
96. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
97. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
98. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
99. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
100. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
101. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
102. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
103. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
104. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
105. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
106. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
107. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
108. UBC - Uniform Building Code; (See ICC).
109. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
110. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
111. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  2. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  3. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
  2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
  3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
  4. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
  5. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
  6. FG - Federal Government Publications; [www.gpo.gov](http://www.gpo.gov).
  7. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  8. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
  9. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
  10. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  2. FED-STD - Federal Standard; (See FS).
  3. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
  4. MILSPEC - Military Specification and Standards; (See DOD).
  5. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 014200

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
- C. Temporary utilities include but are not limited to:
  - 1. Temporary electric power and light.
  - 2. Temporary heating, cooling and ventilating.
  - 3. Telephone service.
  - 4. Water services and distribution.
  - 5. Temporary sanitary facilities, including drinking water.
  - 6. Temporary sewers and drainage
  - 7. Temporary fire protection.
- D. Security includes but is not limited to:
  - 1. Security enclosures, fences and lockups
- E. Temporary controls include but are not limited to:
  - 1. Environmental protection
  - 2. Nuisance dust control
  - 3. Noise control.

#### 1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Engineer, testing agencies, and authorities having jurisdiction.

- B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- F. Electric Power Service from Existing System: electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Waste handling procedures.
  - 4. Other dust-control measures.

#### 1.5 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations and authorities having jurisdiction, including but not limited to:
  - 1. Building Code requirements
  - 2. Health and safety regulations
  - 3. Utility company regulations
  - 4. Police, Fire Department and Rescue Squad rules.
  - 5. Environmental protection regulations.

- B. Standards: Comply with NFPA Code 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- D. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Temporary Utilities: Prepare a schedule indicating dates of implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary services to use of the permanent service.
- C. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire preventative measures. Do not overload facilities, or permit them to interfere with progress of work. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts. Provide blue reinforced scrim sheeting on all exterior fencing.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

## 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Engineer, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
  - 3. Drinking water and private toilet.
  - 4. Coffee machine and supplies.
  - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 75 deg F.
  - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.
- B. Air-Exhaust Units: Provide negative pressure (relative to adjacent spaces) with dedicated, temporary fans and air barriers during dust or smoke generating activities. Configure to run continuously.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixture where exposed to moisture.

- F. First Aid Supplies: Comply with governing regulations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the University Representative and shall be built with labor and materials furnished by the Contractor without expense to the University. The temporary buildings and utilities shall remain the property of the Contractor at its expense upon completion of the Work. With the written consent of the University Representative, the buildings and utilities may be abandoned and need not be removed.
- D. Noise Control: The Contractor shall make every effort to minimize noise disruption to occupants of buildings and adjacent buildings. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site. No noise generating work that interferes with classroom operation shall be tolerated. No noise generating work shall be allowed during exam periods where the noise will impact classroom functions. Examples of noise generating work include, but are not limited to sawing, drilling and hammering and/or jackhammering.
1. Avoid use of tools and equipment, which produce harmful noise. No gasoline-powered equipment shall be used during times that the buildings are occupied. No gasoline-powered equipment may be used in the interior of buildings at any time.
- E. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
1. All removed materials that are salvageable are the property of the Contractor unless otherwise noted in the specifications.
  2. All debris resulting from the performance of this contract will be the property of the Contractor and will be completely removed from the campus and disposed of in a legal manner.
  3. Chutes and dumpster type containers designed to keep dust and spillage to a minimum will be used by the Contractor. Dumpsters will be completely covered with a waterproof covering at all times when not in use.

- F. Nuisance Dust Control: The following provisions shall apply during demolition or construction phases of work:
1. It is the intent of this specification to insure that nuisance dusts resulting from demolition or construction activities do not impact occupied areas of the building. The Contractor shall take all measures necessary to accomplish this goal. These measures will include as minimum polyethylene sheeting or wet methods of fugitive dust control.
  2. The Contractor shall submit a plan prior to commencement of work that will detail all methods of dust control. This plan shall be approved by the University Representative prior to commencement of work. Upon approval, this plan shall be distributed to the University Representative and the building representative on the Safety Committee.
  3. Failure to comply shall result in immediate stoppage of work until effective dust control measures are employed.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  2. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  3. The University must be notified at least 72 hours in advance of any proposed interruption in order that all affected departments may be advised and have time to adjust their schedules accordingly.
  4. Any service (steam, water, electricity, etc.) shutdown which will interrupt the continuity of an experiment or be detrimental to a research project or which, in the opinion of the University, is required for other valid reasons, shall be maintained by safe and adequate temporary means and such temporary piping, wiring and associated devices shall be removed when no longer required.
  5. The University reserves the right to limit the down time to a specified number of net hours and to set the date for each occasion of complete shutdown.
  6. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
- B. Sewers and Drainage: If sewers are available, provide temporary connection to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
  2. Connect temporary sewers to the municipal system as directed by the sewer department officials.

- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Use of Owner's existing sanitary facilities will not be permitted.
  2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
  3. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used materials.
  4. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
    - a. Provide safety showers, eyewash fountains and similar facilities for convenience, safety and sanitation of personnel
  5. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. The Contractor shall provide temporary heat during construction for interior areas included in the Contract, and any adjacent or nearby occupied areas, to counteract low temperatures or excessive dampness and in any event, between October 15<sup>th</sup> and May 15<sup>th</sup>, maintain during said period or periods until final completion of the Contract, unless otherwise approved by the University representative in writing. Provide heat and ventilation to maintain specified conditions for construction operations and to protect materials and finishes from damage by temperature or humidity. Costs shall be paid by the Contractor. Unless otherwise specified in the Contract Documents, the temporary heating shall be sized to maintain the following conditions on a 24-hour-per-day basis:
    - a. Plant/Warehouses/Storage: 55 degrees F
  2. The areas listed above are for example only. The University Representative shall have sole discretion to assign minimum heating criteria.
- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
1. Connect temporary service to Owner's existing power source, as directed by Owner.
  2. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 volts, AC 20

ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance

- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephones: Provide cellular telephone service for all personnel engaged in construction activities, throughout the construction period. Contractor shall arrange and pay for his own telephone service.
1. Post or maintain within a project notebook a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Engineers' offices.
    - f. University Representative office.
    - g. Principal subcontractors' field and home offices.
- I. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering adjacent/occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect or cover supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area using dedicated fans, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- J. Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
  2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
4. Provide supervision of all welding operations, combustion type temporary heating units, and similar sources of fire ignition.
5. No gasoline shall be stored in or close to any building at any time.

### 3.3 SUPPORT FACILITIES INSTALLATION

#### A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
3. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.

#### B. Field Offices and Sheds: A field office is not required for this project, however should the Contractor choose to provide a field office, see requirements below:

1. Provide non-combustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
2. Field Offices: Provide insulate, weathertight temporary offices with electric lighting, air conditioning and heat and of sufficient size to accommodate required office personnel at the Project Site. The Field Office shall have two rooms, each approximately 150 square feet in size. The offices shall have ample natural light, a heater of sufficient capacity to maintain 70 degrees F in winter and an air conditioner of sufficient capacity to maintain 75 degrees F in summer. No trailer will be allowed on University property unless permanent markings indicating the name of the company are clearly visible. Keep the office clean and orderly of use for small progress meetings. Furnish and equip offices with a minimum of the following:
  - a. Furnish with desks and chairs, file cabinets, plan tables, plan racks, waste receptacles, conference room table and at least eight chairs.
  - b. Equip with a water cooler and private toilet complete with water closet, lavatory and mirror-medicine cabinet unit.
  - c. Equip with a 5 lb ABC fire extinguisher and an OSHA-approved first aid kit. Equip with a facsimile machine and copier for use by the Contractor, University Representative and Engineer.

#### C. Temporary Use of Permanent Roads and Paved Areas: Maintain access for fire-fighting equipment and access to fire hydrants.

- D. Waste disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 1 Section "Execution."
- E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- F. Existing Elevator Use: The Contractor will be permitted use, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
  - 1. Do not load elevators beyond their rated weight capacity.
  - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- G. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
  - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

#### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and staging area.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- D. Temporary Egress: Maintain temporary egress from existing occupied facilities at all times and as required by authorities having jurisdiction.

- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- F. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
  - 1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
  - 2. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  - 3. Protect air-handling equipment.
  - 4. Provide walk-off mats at each entrance through temporary partition.
- G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
  - 1. Prohibit smoking in construction areas.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with University fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 TRAFFIC CONTROL

- A. Due to the large volume of pedestrian and vehicular traffic within the campus, it shall be the responsibility of the Contractor to provide continuous traffic accessibility to all areas of the campus.
- B. The Contractor shall comply with Connecticut Regulation 13b-17-28, Safety to Traffic, which requires that "When portions of the traveled way are made dangerous for the movement of vehicles or pedestrians, a sufficient number of uniformed police officers, flagmen, or traffic men, shall be employed by the permittee to direct traffic safely through the area."

- C. The requirement to maintain pedestrian and vehicular traffic is further defined in the Connecticut Department of Transportation Specifications Section 9.71, Form 814, which requirements are incorporated herein by reference.
- D. The Contractor may contact the University Police Department, Town of Mansfield Police Department, or other private sources to obtain the necessary manpower to comply with these regulations. The University Representative assigned to the given construction project shall be informed by the General Contractor of his traffic control procedures prior to the commencement of construction.

### 3.6 PROJECT IDENTIFICATION AND SIGNS

- A. Project Identification Signs: Provided and installed by the University.
- B. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
- C. Other Signs: Any other signage shall be submitted to the University Representative for approval.

### 3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Unless the University Representative requests that it be maintained longer, remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

- a. Replace air filters and clean inside of ductwork and housings.
- b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
- c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.
- d. Restore all existing facilities and grounds used during construction to specified or to original condition.

END OF SECTION 015000

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Division 01 Section "Allowances" for products selected under an allowance.
  - 2. Division 01 Section "Alternates" for products selected under an alternate.
  - 3. Division 01 Section "Substitution Procedures" for requests for substitutions.
  - 4. Section 014200 "References" for applicable industry standards for products specified.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

#### 1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
  2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Division 01 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Engineer will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations and not by previous Project experience. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where Specifications name only a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Semiproprietary Specification Requirements: Where Specifications name three or more products or manufacturers, provide one of the products indicated. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
    - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
  6. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Proposed changes are in keeping with the intent of Contract Documents.
  3. The request is timely, fully documented and properly submitted.
  4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
  5. The specified product or method of construction cannot be provided within the Contract Time.
    - a. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deduction offsetting responsibilities the Owner may be required to bear.
    - a. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
  8. The specified product or method of construction cannot be provided in a manner that is compatible with other material, and where the Contractor certifies that the substitution will overcome the incompatibility.
  9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
  11. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  12. Evidence that proposed product provides specified warranty.
  13. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
  14. Samples, if requested.

- B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work.
  - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 016000

SECTION 016100 – UNIVERSITY PRODUCT STANDARD

1.1 ASBESTOS CERTIFICATION

- A. Contractor shall certify that all material/equipment installed in any portion of the Work shall be asbestos free. The owner may perform sampling to verify all suspect material/equipment is asbestos free. If any material/equipment is found to contain asbestos, the Contractor shall pay for the lawful and proper removal and disposal of product(s), and re-install acceptable material/equipment all at its sole expense.

1.2 FOR PURPOSES OF THIS REQUIREMENT, MATERIALS INCLUDE, **BUT ARE NOT LIMITED TO THE FOLLOWING:**

A. Surfacing Treatments

- 1. Fireproofing Acoustical Plaster
- 2. Finish Plasters, Skim Coats of Joint Compound, Fibrous Type Paint Applications, Sprayed-on applications

B. Thermal System Insulation

- 1. Equipment Insulation, Gaskets, Valve Packings,
- 2. Boiler, Breeching, Boiler Rope, Duct or Tank Insulation,
- 3. Cement or Mortar used for boilers and refractory brick.
- 4. Piping and Fitting Insulations including but not limited to Wrapped Paper, Millboard, Rope, Cork, Preformed Plaster, Job Molded Plaster and Coverings over Fibrous Glass Insulation.

C. Roofing and Siding Materials

- 1. Insulation Board, Vapor Barriers, Felts, Coatings & Adhesives,
- 2. Flashing, Shingles, Cementitious Board (Transite),
- 3. Galbestos, Non-Metallic or Non-Wood Roof Decking

D. Other Miscellaneous Materials

- 1. Cove Base, Floor Leveling Compound,
- 2. Ceiling & Floor Tiles, Vibration Isolators, Laboratory Tables and Hoods,
- 3. Mastics, Adhesives, Coatings & Caulks,
- 4. Wallboard & Joint Compounds,
- 5. Friction Products, Gaskets,
- 6. Fire Door Materials, Cementitious Products (Transite)

- E. The Contractor certifies that all material/equipment installed in any portion of the Work shall be asbestos free:

Contractor Signature:

Date:

Print Name:

Company:

1. Please keep a completed copy of this document in the department's project files and mail or fax a copy to:
  - a. University of Connecticut, Department of Environmental Health and Safety, Unit 4097, 486-1106 (FAX)

END OF SECTION 016100

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Installation of the Work.
  - 3. Cutting and patching.
  - 4. Progress cleaning.
  - 5. Starting and adjusting.
  - 6. Protection of installed construction.
- B. Related Requirements:
  - 1. Division 01 Section "Summary" for limits on use of Project site.
  - 2. Division 01 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  - 4. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.
  - 5. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

#### 1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
  - a. Primary operational systems and equipment.
  - b. Fire separation assemblies.
  - c. Air or smoke barriers.
  - d. Fire-suppression systems.
  - e. Mechanical systems piping and ducts.
  - f. Control systems.
  - g. Communication systems.
  - h. Fire-detection and -alarm systems.
  - i. Electrical wiring systems.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety
  - a. Water, moisture, or vapor barriers.
  - b. Membranes and flashings.
  - c. Exterior wall construction.
  - d. Sprayed fire-resistive material.
  - e. Equipment supports.
  - f. Piping, ductwork, vessels, and equipment.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to University Representative that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other

utility appurtenances located in or affected by construction. And coordinate with authorities having jurisdiction.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Division 01 Section "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the plans. If discrepancies are discovered, notify Engineer promptly.
- B. General: lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
- C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

### 3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  4. Maintain minimum headroom clearance of 96 inches.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

- b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

### 3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Submittal of Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Division 01 Section "Execution" for progress cleaning of Project site.
  - 3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
  - 6. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by University Representative. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain University Representative signature for receipt of submittals.
  - 5. Submit test/adjust/balance records.
  - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise Owner of pending insurance changeover requirements.
  - 2. Complete startup and testing of systems and equipment.
  - 3. Perform preventive maintenance on equipment used prior to Substantial Completion.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings when specified in Division 01 Section "Demonstration and Training."
  5. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
  6. Complete final cleaning requirements, including touchup painting.
  7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  2. Submit an updated final Application for Payment statement, accounting for final additional charges to the Contract Sum.
  3. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  4. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  5. Submit consent of surety to final payment.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Upon completion of reinspection, the University Representative with advice of the Engineer will prepare a Certificate of Final Acceptance, or advise the Contractor of Work

that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

3. If necessary, reinspection will be repeated.

#### 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Engineer.
  - d. Name of Contractor.
  - e. Page number.
4. Submit list of incomplete items in the following format or format approved by Owner:
  - a. MS Excel electronic file. Engineer will return annotated file.

#### 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## 1.10 REVENUE SERVICES REQUIREMENTS

- A. Upon receipt of the Certificate of Substantial Completion, the Contractor shall submit the following information required by the Connecticut Department of Revenue Services.
  - 1. The identity and addresses of all subcontractors performing work on the project.
  - 2. The Connecticut tax registration numbers of the General Contractors and all subcontractors.
  - 3. The Federal Social Security account numbers, or Federal Employer Identification numbers, or both, if applicable, for the General Contractor and all subcontractors.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
    - b. Clean catch basins affected by construction activities.
    - c. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - d. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

- e. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - f. Remove snow and ice to provide safe access to building.
  - g. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - h. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
  - i. Sweep concrete floors broom clean in unoccupied spaces.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - o. Leave Project clean and ready for occupancy.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.

- a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

### 3.3 CERTIFICATIONS

- A. The Contractor, at completion of construction, shall provide to the University a "Certificate of Substantial Compliance" bearing original signatures of an officer of the company stating: "this is to CERTIFY that, in my professional opinion, the complete structure/renovations described above is in substantial compliance with the approved construction documents on file with the University of Connecticut. Minor deviations and special stipulations are noted below (if any)"
- B. Prior to Owners' approval and acceptance, mechanical and electrical systems shall be fully operational.

END OF SECTION 017700



# PUNCH LIST

Project: \_\_\_\_\_  
\_\_\_\_\_  
To (Contractor): \_\_\_\_\_  
\_\_\_\_\_

From (A/E): \_\_\_\_\_  
Site Visit Date: \_\_\_\_\_  
A/E Project Number: \_\_\_\_\_  
Contract For: \_\_\_\_\_

The following items require the attention of the Contractor for completion or correction. This list may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Item Number	Room Number	Location (Area)	Description	Correction/Completion Date	Verification A/E Check
----------------	----------------	--------------------	-------------	-------------------------------	---------------------------

Attachments

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

Copies:  Owner  Consultants  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  File

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 01 Section "General Commissioning Requirements"
  - 3. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
  - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
  - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.
  1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Engineer.
  7. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
  8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Emergency Procedures: Include the following, as applicable:
  1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.3 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
  2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- D. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one color set(s) of marked-up record prints. Submit PDF electronic files of scanned record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Pipe size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Engineer's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Engineer for resolution.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Engineer.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  5. Note related Change Orders and record Drawings where applicable.

- B. Format: Submit Record Specifications as annotated PDF electronic file.

### 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
- C. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

### 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as electronic copy.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's and Owner Representative's reference during normal working hours.

END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Requirements:
  - 1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

#### 1.4 CLOSEOUT SUBMITTALS

- A. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

## 1.5 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

## 1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

## 1.7 PRODUCTS

## 1.8 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Operations manuals.
    - b. Maintenance manuals.

- c. Project record documents.
  - d. Identification systems.
  - e. Warranties and bonds.
  - f. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.

8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## PART 2 - EXECUTION

### 2.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### 2.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Engineer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner through Owners Representative with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site or give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

## SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Sections:
  - 1. Section 230800 "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

#### 1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

#### 1.4 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, and suppliers.
- B. Members Appointed by Owner:
  - 1. Representatives of the facility user and operation and maintenance personnel.
  - 2. Engineer and engineering design professionals.

#### 1.5 OWNER'S RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

## 1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  - 1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  - 2. Cooperate with the Engineer for resolution of issues recorded in the Issues Log.
  - 3. Attend commissioning team meetings held on a variable basis.
  - 4. Integrate and coordinate commissioning process activities with construction schedule.
  - 5. Develop, review and accept construction checklists provided by the vendors and subcontractors. Forward to Engineer for review.
  - 6. Complete electronic construction checklists as Work is completed and provide to the Engineer on a weekly basis.
  - 7. Complete commissioning process test procedures.
  - 8. Compile test data, inspection reports, and certificates; include them in the operations manual.

## 1.7 ENGINEER'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Convene commissioning team meetings.
- D. Review project-specific construction checklists and commissioning process test procedures which are submitted in draft form by the contractor.
- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the specifications. When a random sample does not meet the requirement, the Engineer will report the failure in the Issues Log.
- F. Prepare and maintain the Issues Log.
- G. Prepare and maintain completed construction checklist log.
- H. Witness systems, assemblies, equipment, and component startup, on a periodic basis.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 019113

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of selected portions of building or structure.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 017300 "Execution" for cutting and patching procedures.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:

- 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

- B. Inventory: Submit a list of items to be removed and deliver to Owner prior to start of demolition.
- C. Predemolition Photographs: Submit before Work begins.

## 1.6 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Storage or sale of removed items or materials on-site is not permitted.
- C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  1. Maintain fire-protection facilities in service during selective demolition operations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain adequate ventilation when using cutting torches.
  - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

8. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel supports for mechanical and electrical equipment.
  - 2. Steel supports for applications where supports are not specified in other Sections.
  - 3. Steel ladders.
  - 4. Steel grating.
  - 5. Steel guardrails.
  - 6. Loose bearing and leveling plates for applications where they are not specified in other Sections.
  - 7. Note: Structural steel is not included in this specification. All platform supports are considered structural steel and shall be fabricated and erected in accordance with AISC Manual of Steel Construction, 9<sup>th</sup> edition and AISC's "Code of Standard Practice for Steel Buildings and Bridges". Refer to Structural General Notes on drawing S0.01 for further information regarding structural steel.

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
  - 1. Steel supports for mechanical and electrical equipment.
  - 2. Steel supports for applications where supports are not specified in other Sections.
  - 3. Steel ladders, grating and guardrails.

## 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of equipment and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A 653 structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

### 2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy [Group 1] [Group 2].
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1] stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.3 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099123 Painting.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

## 2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.

- C. Galvanize miscellaneous framing and supports where indicated.

## 2.6 METAL LADDERS

### A. General:

- 1. Comply with ANSI A14.3.

### B. Steel Ladders:

- 1. Space siderails 16 inches apart unless otherwise indicated.
- 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
- 3. Rungs: 3/4-inch-diameter steel bars.
- 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
- 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- 6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

## 2.7 GRATINGS

- A. Provide steel grating as indicated on the drawings. Grating shall conform to requirements of ASTM A 569, welded steel grating and comply with ANSI/NAAMM MBG 531 "Metal Bar Grating Manual."
- B. Steel Grating: 1 x 1/2 inch bearing bars at 1-3/16 inches on center. Cross bars at 4 inches on center maximum.
  - 1. Finish: Painted.

## 2.8 STEEL PIPE GUARDRAILS

- A. Fabricate railings and guardrails of 1-1/2 inch (nominal) diameter steel pipe, unless otherwise shown.
- B. Railings: Unless otherwise shown, railings shall consist of top rail and intermediate rails, with posts spaced not more than 5 feet on center. Close ends of rails which do not terminate with a flange or continuous return.
- C. Space top rail and two intermediate rails equally as shown on drawings. Top of top rails shall be 42 inches above top of grating.
- D. Join posts, rails, and corners as follows:
  - 1. Coped and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding joints smooth. Butt railing splices and reinforce by a tight-fitting interior pipe sleeve not less than 6 inches long secured in place.

2. Railings may be bent at corners instead of joining, provided the bends are uniformly formed in jigs, with cylindrical cross-section of pipe maintained throughout the entire bend.
  - E. Unless otherwise shown, fabricate railings and accessories as necessary to secure posts and rail ends to construction as follows:
    1. Guardrail posts to be directly welded to the steel supporting members.
  - F. Toeplates: Flat steel plate 3/16 x 4 inches continuous at guardrails. Weld plate to new or existing steel beams as indicated.
  - G. Finish: Painted.
- 2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.10 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, through bolts and other connectors.

#### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

#### 3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 Painting.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

## SECTION 078413 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
  - 3. Penetrations in smoke barriers.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For qualified Installer.
- C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
- b. Classification markings on penetration firestopping correspond to designations listed by the following:
  - 1) UL in its "Fire Resistance Directory."

## 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. A/D Fire Protection Systems Inc.
  2. Grace Construction Products.
  3. Hilti, Inc.
  4. Johns Manville.
  5. Nelson Firestop Products.
  6. NUCO Inc.
  7. Passive Fire Protection Partners.
  8. RectorSeal Corporation.
  9. Specified Technologies Inc.
  10. 3M Fire Protection Products.
  11. Tremco, Inc.; Tremco Fire Protection Systems Group.
  12. USG Corporation.

## 2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  1. Fire-resistance-rated walls include fire walls.
  2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  1. Horizontal assemblies include floors and ceiling membranes of roof/ceiling assemblies.
  2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  4. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
  1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-wool-fiber or rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
  2. Temporary forming materials.
  3. Substrate primers.
  4. Collars.
  5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- D. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- E. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- F. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- H. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

#### 3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

#### 3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

## SECTION 099123 - PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior and exterior substrates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
  - 3. VOC content.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Behr Process Corporation.
  2. Benjamin Moore & Co.
  3. Dunn-Edwards Corporation.
  4. Duron, Inc.
  5. Sherwin-Williams Company (The).
  6. Vista Paint.

### 2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Colors: As selected by University from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
  - 1. SSPC-SP 3, "Power Tool Cleaning."
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
  - 1. Alkyd System: MPI INT 5.1D. System thickness 5 mils dft.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Interior alkyd matching topcoat.
    - c. Topcoat: Interior alkyd (semigloss).

### 3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
  - 1. Alkyd System: MPI EXT 5.1D. System thickness 5 mils dft.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (semigloss).
- B. Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Topcoat: Latex, interior, flat, (Gloss Level 1), MPI #53.

END OF SECTION 099123

## SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
- B. Related Sections:
  - 1. Section 221513 "General-Service Compressed-Air Piping" for valves applicable only to this piping.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B31.9 for building services piping valves.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.

- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.

### 2.2 BRONZE BALL VALVES

- A. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

#### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint valve-end.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, regular port, bronze with bronze trim.

END OF SECTION 220523

## SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes piping and related specialties for compressed-air systems operating at 150 psig or less, serving instrumentation and valve actuators.
- B. Related Sections include the following:
  - 1. Section 220523 "General-Duty Valves for Plumbing Piping."

#### 1.3 DEFINITIONS

- A. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Pressure regulators. Include rated capacities and operating characteristics.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Brazing certificates.
- B. Qualification Data: For Installers.
- C. Field quality-control test reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- B. ASME Compliance:
  - 1. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

## 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:
  - 1. Notify University no fewer than two days in advance of proposed interruption of compressed-air service.
  - 2. Do not proceed with interruption of compressed-air service without University's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K seamless, drawn-temper, water tube.
  - 1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
  - 2. Copper Unions: ASME B16.22 or MSS SP-123.
- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.2 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

## 2.3 VALVES

- A. Metal Ball Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Hart Industries International, Inc.
    - c. Jomar International Ltd.
    - d. Matco-Norca, Inc.
    - e. McDonald, A. Y. Mfg. Co.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - g. Wilkins; a Zurn company.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 150 psig.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## 2.5 SPECIALTIES

- A. Air-Line Pressure Regulators:
  - 1. Selected by Chiller manufacturer for the intended service.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
  - 1. NPS 2 and Smaller: Type K, copper tube; wrought-copper fittings; and brazed or soldered joints.

### 3.2 VALVE APPLICATIONS

- A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping" for metal general-duty valves. Use metal valves, unless otherwise indicated.
  - 1. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Section 220523 "General-Duty Valves for Plumbing Piping" according to the following:
    - a. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.

### 3.3 PIPING INSTALLATION

- A. Schematics indicate general arrangement of compressed-air piping. Contractor shall field-route piping, as indicated on approved on Coordination Drawings.
- B. Install piping protected from physical contact by building occupants.
- 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 otherwise indicated.
- D. Install piping adjacent to equipment and machines to allow service and maintenance.
- E. Install air piping with 1 percent slope downward in direction of flow.
- F. Install nipples, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- G. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- H. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- I. Install piping to permit valve servicing.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.

### 3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. 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:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. 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.
- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

### 3.5 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to equipment and valve actuators.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

### 3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 and Smaller: Use dielectric unions.

### 3.7 CONNECTIONS

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
  2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- D. Support horizontal piping within 12 inches of each fitting and coupling.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1/4: 60 inches with 3/8-inch rod.
  2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
  3. NPS 3/4: 84 inches with 3/8-inch rod.
  4. NPS 1: 96 inches with 3/8-inch rod.
  5. NPS 1-1/4: 108 inches with 3/8-inch rod.
  6. NPS 1-1/2: 10 feet with 3/8-inch rod.
  7. NPS 2: 11 feet with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.

### 3.9 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 230553 "Identification for HAVAC Piping and Equipment."

### 3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
  2. Repair leaks and retest until no leaks exist.
- C. Prepare test reports.

END OF SECTION 221513

## SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

#### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient design, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings:
  - 1. Motors shall be complete with antifriction ball bearings. Bearings shall be in accordance with AFBMA standard 9 and shall be selected to provide a minimum L10 service life of 100,000 hours.
  - 2. Bearings shall be regreasable and shall be complete with plugs or alemite grease fittings or bearings can be "sealed-for-life" type for smaller than equal to 215T frame motors. Regreasable bearings shall be designed with double shields to prevent the ingress of any foreign substance.
- F. Temperature Rise: Class B.
- G. Insulation: Class F.
- H. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
- I. Enclosure Material: Cast iron for motor frame sizes **324T** and larger; rolled steel for motor frame sizes smaller than **324T**.
- J. Enclosure Type:
  - 1. Motors larger than ¼ HP shall be totally enclosed fan cooled (TEFC).
- K. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Other manufacturers will be considered for bid only if they can promptly demonstrate equivalency in product quality, capability to deliver on schedule and service support.
  - 1. Baldor
  - 2. US Motors
  - 3. GE
  - 4. Marathon

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
  5. Shaft Grounding Ring: Motors used with VFC's shall have a maintenance-free, conductive microfiber shaft grounding ring with a minimum of two rows of circumferential microfingers installed on the drive-end of the motor shaft to discharge electrical shaft currents within the motor and/or its bearings to ground. The opposite end shall have one bearing journal insulated, or ceramic bearing.
    - a. Application note: Motors up to 100 hp shall be provided with a minimum of one shaft grounding ring installed on either the drive end or non-drive end. Motors over 100 hp shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Other manufacturers will be considered for bid only if they can promptly demonstrate equivalency in product quality, capability to deliver on schedule and service support.
1. Baldor
  2. US Motors
  3. GE
  4. Marathon

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 230513

## SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  1. Thermowells.
  2. Dial-type pressure gages.
  3. Gage attachments.
  4. Ultrasonic flow meters.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 THERMOWELLS

- A. Thermowells:
  1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  3. Material for Use with Steel Piping: **CRES**.
  4. Type: Stepped shank unless straight or tapered shank is indicated.
  5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

## 2.2 PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ashcroft Inc.
  - b. Treice, H. O. Co.
  - c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - d. Weiss Instruments, Inc.
  - e. WIKA Instrument Corporation USA.
  - f. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 3 1/2 inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.3 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of stainless-steel pipe with NPS 1/4 pipe threads.
- C. Valves: Brass or stainless-steel needle, NPS 1/4, ASME B1.20.1 pipe threads.

## 2.4 FLOW METERS

### A. Ultrasonic, Flow Meters (FT-OCHW-108, FT-OCW-008):

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Panametrics model AT868W-1-1-1-1, or approved equal.
2. General: The meter supplier shall provide a dual channel, clamp-on, Transit Time Ultrasonic Flow Meter, complete with matched transducers, self-aligning installation

hardware and coaxial transducer cables. The flow meter shall be installed without making any openings in the pipe wall and shall utilize non-wetted ultrasonic transducers that may be located up to 300 ft from the meter. Ultrasonic transducers provided must be optimized for the specific pipe & process conditions for each application and the transducer frequency shall be automatically matched to the resonant frequency of the pipe at start-up. An integral auto-zero function shall be provided for zero precision and high accuracy, even at very low flow velocities.

3. Indicator: Local LED display.
4. Materials
  - a. Transducer Mounting Hardware: Anodized aluminum or stainless steel.
  - b. Transducers: Anodized aluminum, plastic or stainless steel.
5. Performance:
  - a. Accuracy : Shall be within  $\pm 1\%$  of rate from 1 to 40 ft/sec and  $\pm 0.01$  ft/sec for velocities below 1 ft/sec.
  - b. Overall Flow Range: 0.1 to 40 ft/sec.
  - c. Turndown: Overall turndown shall exceed 400:1.
  - d. Sensing Method: Clamp-on ultrasonic, differential transit time method in direct or reflect mode.
  - e. Fluid Temperature Range: -40 degrees F to 250 degrees F.
  - f. Ambient Temperature Range: 14 degrees F to 122 degrees F.
6. Electronics:
  - a. Supply Voltage: 120 VAC.
  - b. Output signal shall be 4 to 20 mA.
  - c. Input Power: Factory selectable 11.5 to 28.5 VDC, 20 Watts maximum.
  - d. Calibration: Calibrate electronics in factory. Provide factory calibration certificate for each meter.
7. Provide meters for the following conditions:
  - a. Design Fluid: Chilled Water (30-150 degrees F)
  - b. Pipe Type: Schedule 40 Carbon Steel
8. Accuracy: Shall be within  $\pm 1\%$  of rate from 1 to 40 ft/sec and  $\pm 0.01$  ft/sec for velocities below 1 ft/sec.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- H. Install valve and syphon fitting in piping for each pressure gage for steam.
- I. Flowmeter:
  - 1. Install all flow meters as recommended by the manufacturer with appropriate upstream and downstream straight lengths of pipe at all times. Consideration shall be given to upstream interferences such as out of plane elbows and fittings.
    - a. The location of the components of the hydronic energy distribution meter shall comply with the straight-run pipe upstream and downstream requirements recommended by the manufacturer(s). The straight-run pipe distance shall not be less than 15 times the diameter (15D) of the pipe, 10D upstream and 5D downstream. Consideration shall be given to upstream interferences such as out of plane elbows and fittings, as defined in the manufacturer's literature.
  - 2. All meters and ancillary equipment shall be installed in such a manner as to provide access for routine inspections, maintenance, and a means of removal.
  - 3. The flow computer readout/display shall be located between 5 feet and 6 feet above finished floor level.
- J. Install permanent indicators on walls or brackets in accessible and readable positions.
- K. Install thermometers in the following locations:
  - 1. Two inlets and two outlets of each chiller.
  - 2. Where shown on drawings.
- L. Install pressure gages in the following locations:
  - 1. Inlet and outlet of each chiller chilled-water and condenser-water connection.
  - 2. Suction and discharge of each pump.
  - 3. Where shown on drawings.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.

- C. Connect flowmeter transmitters to meters.

### 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlets and outlets of each chiller shall be the following:
  - 1. **Industrial**-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.
- B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.
- C. Scale Range for Steam and Steam-Condensate Piping: 50 to 400 deg F.

### 3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:
  - 1. Liquid-filled, direct-mounted, metal case.
- B. Pressure gages at suction and discharge of each pump shall be the following:
  - 1. Liquid-filled, direct-mounted, metal case.

### 3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 160 psi.
- B. Scale Range for Condenser-Water Piping: 0 to 100 psi.
- C. Scale Range for Steam Piping: 0 to 200 psi.

3.8 FLOWMETER SCHEDULE

- A. Flowmeters for Chilled-Water Piping: Ultrasonic type.
  - 1. Design Flow: 4200 GPM
  - 2. Flow Range: 0-7500 GPM
  
- B. Flowmeters for Condenser-Water Piping: Ultrasonic type.
  - 1. Design Flow: 6300 GPM
  - 2. Flow Range: 0-10000 GPM

END OF SECTION 230519

## SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Steel ball valves.
2. High-performance butterfly valves.
3. Steel swing check valves.
4. Steel, plate-type, silent check valves.
5. Steel gate valves.
6. Steel globe valves.

- B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller.

4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.5.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.
4. Socket Weld: With sockets according to ASME/ANSI 16.11.

G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 STEEL BALL VALVES

A. Three-Piece, Full-Port, Stainless Steel Ball Valves with Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Sharpe Valves.
  - d. Velan.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 PSIG.
  - c. Body Design: Three piece.
  - d. Body Material: Stainless Steel, ASTM A351 CF8M.
  - e. Body and Bonnet Bolting: 316 Stainless Steel.
  - f. Ends:
    - 1) 2" NPS and smaller: Threaded or Socket-Weld.
  - g. Seats: PTFE.
  - h. Stem: 316 Stainless Steel.
  - i. Ball: 316 Stainless Steel.
  - j. Port: Full.
  - k. Operator: Lever (6" and larger shall be gear operated)

B. Two-Piece, Full-Port, Stainless Steel Ball Valves with Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Sharpe Valves.
  - d. Velan.
  - e.
  
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 PSIG.
  - c. Body Design: Two piece.
  - d. Body Material: 316 Stainless Steel.
  - e. Body and Bonnet Bolting: 304 Stainless Steel.
  - f. Ends:
    - 1) 2" NPS and smaller: Socket Weld. ASME B16.11.
  - g. Seats: PTFE.
  - h. Stem: 316 Stainless Steel.
  - i. Ball: 316 Stainless Steel.
  - j. Port: Full.
  - k. Operator: Lever (6" and larger shall be gear operated)

## 2.3 BRONZE BALL VALVES

### A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Hammond Valve.
  - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE or TFE.

- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

## 2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

### A. Class 150, High Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bray.
  - b. Ebro.
  - c. DeZurick.
  - d. Flowseal.
  - e. Jamesbury.
  - f. Tyco/Keystone.
2. Description:
  - a. Standard: MSS SP-67.
  - b. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - c. Body Material: Carbon Steel, A216 Gr. WCB.
  - d. Disc: 316 Stainless Steel.
  - e. Ends: Lugged Ends
  - f. Seals: Graphite
  - g. Seat: Reinforced PTFE.
    - 1) Seat retainer ring shall be bolted in place with stainless steel bolts
    - 2) Seat materials shall be compatible with acidic condenser water with bleach biocide and with nitrite based chilled water treatment chemicals.
  - h. Stem: 17-4PH Stainless steel; offset from seat plane.
  - i. Service: Bidirectional.
  - j. Operator:
    - 1) Manual Gear with Handwheel and Position Indicator.
    - 2) Actuator per section 230900 "Instrumentation and Control for HVAC."

### B. Class 300, Double-Flange, High-Performance Butterfly Valves:

1. Provide Zwick model B1/ Series Tri-Con, or approved equal.
2. Description:
  - a. Operator: Manual gear with handwheel and position indicator, Rotork Gears model AB 880N, or approved equal.

## 2.5 GATE VALVES

### A. Class 800, Forged Steel, Bolted Bonnet, Standard Port Gate Valves:

1. Provide Bonney Forge model HL 11, Velan model A, or equal.
2. Description:
  - a. Standard: B16.34
  - b. SWP Rating: 150 PSIG.
  - c. Body Material: A 105.
  - d. Stem Material: CR13.
  - e. Disc/Wedge Material: CR13.
  - f. Seat Material: CR13.HF.
  - g. End Connections: Socket weld.

B. Class 300, Cast Carbon Steel, OS&Y Gate Valves:

1. Provide Newco model 13F-CB2, or equal.
2. Description:
  - a. Standard: B16.34
  - b. SWP Rating: 150 PSIG.
  - c. CWP Rating: 740 PSIG.
  - d. Body Material: ATM 216, WCB.
  - e. Stem Material: CR13.
  - f. Disc/Wedge Material: CR13.
  - g. Seat Material: CR13.HF.
  - h. End Connections: Class 300, RF Flanged.

2.6 GLOBE VALVES

A. Class 800, Forged Steel, Bolted Bonnet, Globe Valves:

1. Provide Velan model A, Bonney Forge model HL 31, or equal.
2. Description:
  - a. Standard: B16.34
  - b. SWP Rating: 150 PSIG.
  - c. Body Material: A 105.
  - d. Stem Material: CR13.
  - e. Disc Material: CR13.
  - f. Seat Material: HF.
  - g. End Connections: Socket weld.

B. Class 900, Steel, Y-Pattern Stop, Full Port, Globe Valves:

1. Provide Conval model 11G2J-1055F, or equal.
2. Description:
  - a. Standard: B16.34
  - b. SWP Rating: 150 PSIG.
  - c. ASME Pressure Class: 900
  - d. Body Material: A 105.

- e. Stem Material: CR13.
- f. Disc Material: CO-CR.
- g. Seat Material: CO-CR.
- h. Yoke: A 105.
- i. End Connections: Socket weld
- j. Option: I.G.W.

## 2.7 STEEL, GLOBE TYPE, SILENT CHECK VALVES

### A. Class 150, Carbon Steel, Globe Type, Silent Check Valves:

- 1. Provide Titan model CV 51-CS or approved equal.
- 2. Description:
  - a. CWP Rating: 285 PSI at 100 degrees F.
  - b. Body Material: Carbon Steel, A216 Gr. WCB. Epoxy painted.
  - c. Ends: Flanged, ASME B16.5 Class 150 Raised Face.
  - d. Disc: Stainless Steel, Gr. CF8M Type 316.
  - e. Spring: Series 300 Stainless Steel.
  - f. Bushing: Stainless Steel.
  - g. Seat: Stainless Steel, Gr. CF8M Type 316.
  - h. Cap Screw: Stainless Steel.
  - i. Provide integral straightening vanes.
  - j. Body shall have large cross-sectional area to reduce pressure drop across check valve.

## 2.8 DISC CHECK VALVES

### A. Manufacturers:

- 1. Spirax Sarco.
- 2. Apollo Valves.
- 3. Nibco.

### B. Description:

- 1. Type: Austenitic Stainless Steel Disc Check Valve.
- 2. Maximum Operating Pressure: 400 PSIG.
- 3. Maximum Temperature: 350 degrees F.
- 4. Body: Austenitic Stainless Steel, ASTM A351.
- 5. Seat: Austenitic Stainless Steel, ASTM A351.
- 6. Disc: Austenitic Stainless Steel, ASTM A276, 316.
- 7. Spring: Austenitic Stainless Steel, 316.
- 8. End Connections: Socket Weld to ASME B 16.11 Class 3000.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for **butterfly** valves **NPS 4** and larger and more than **96 inches** above floor. Extend chains to **60 inches** above finished floor.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Lift Check Valves: With stem upright and plumb.

#### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, **or gate** valves.
  2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  3. Throttling Service except Steam: **Ball, or butterfly** valves.
  4. Pump-Discharge Check Valves:
    - a. NPS 2-1/2 and Larger: Iron center-guided, **resilient**-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Steel Piping, NPS 2 and Smaller: Threaded or socket-weld ends.
  3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  4. For Steel Piping, NPS 5 and Larger: Flanged ends.

### 3.5 CHILLED-WATER AND CONDENSER/COOLING WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
1. Pressure Gage Isolation:
    - a. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
  2. Drain Connections:
    - a. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
- B. Pipe NPS 2-1/2 and Larger:
1. High-Performance Butterfly Valves: Class 150, high performance butterfly valve.
  2. Class 150, Carbon Steel, Globe Type, Silent Check Valves.

### 3.6 HIGH-PRESSURE STEAM VALVE SCHEDULE (MORE THAN 15 PSIG)

- A. Pipe NPS 2 and Smaller:
1. Gate Valves: Class 800, Forged Steel, Bolted Bonnet, Standard Port Gate Valves.
  2. Globe Valves: Class 800, Forged Steel, Bolted Bonnet, Globe Valves.
  3. Globe Valve, Y-Pattern: Class 900, Steel, Y-Pattern Stop, Full Port, Globe Valves.
- B. Pipe Sizes NPS 2-1/2 and Larger:
1. High-Performance Butterfly Valves: Class 300, double flange.
  2. Gate Valves: Class 300, Cast Carbon Steel, OS&Y Gate Valves.

### 3.7 STEAM-CONDENSATE VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:

1. Gate Valves: Class 800, Forged Steel, Bolted Bonnet, Standard Port Gate Valves.
2. Check Valves: Disc check valve.

END OF SECTION 230523

## SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

- B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Galvanized exterior.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers, where approved for use by the University/Engineer.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
    - a. Do not use mechanical expansion anchors in vertical overhead applications.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Attach building attachments to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. 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.
- L. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 4. Pipes NPS 8 and Larger: Include cellular glass or reinforced calcium-silicate-insulation inserts of length at least 2 inches longer than protective shield.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. 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 1-1/2 inches.

### 3.5 PAINTING

- A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099123 "Interior Painting".
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 13. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  - 16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

18. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  5. C-Clamps (MSS Type 23): For structural shapes.
  6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  11. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.

12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): For metal inserts, to fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Insulated Equipment: Provide second identical manufacturer's nameplate for insulated equipment. Permanently attach second nameplate at a visible location on exterior of insulation.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red .
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as existing, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Fiberboard or metal .
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook .
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: Approximately 4 by 7 inches .
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

#### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting"
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. Near major equipment items and other points of origination and termination.
  - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- D. Pipe Label Color Schedule:
  - 1. Chilled-Water Piping (CHILLED WATER):
    - a. Background Color: Blue.
    - b. Letter Color: White.
  - 2. Condenser-Water Piping:
    - a. Background Color: Blue.

- b. Letter Color: White.
3. Refrigerant Piping:
  - a. Background Color: Black.
  - b. Letter Color: White.
4. High-Pressure Steam Piping (125 PSI STEAM):
  - a. Background Color: Orange.
  - b. Letter Color: White.
5. Steam Condensate Piping (CONDENSATE):
  - a. Background Color: Light Blue.
  - b. Letter Color: White.
6. Compressed Air Piping (COMPRESSED AIR):
  - a. Background Color: Green.
  - b. Letter Color: White.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  1. Valve-Tag Size and Shape:
    - a. Chilled Water: 1-1/2 inches , round .
    - b. Condenser Water: 1-1/2 inches round
    - c. Refrigerant: 1-1/2 inches round .
    - d. High-Pressure Steam: 1-1/2 inches, round .
    - e. Steam Condensate: 1-1/2 inches round .
  2. Valve-Tag Color: Natural
  3. Letter Color: Black

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
    - b. Variable-flow hydronic systems.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within **45** days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within **45** days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Certified TAB reports.
- D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

## 1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by **AABC, NEBB or TABB**.

1. TAB Technician: Employee of the TAB contractor and who is certified by **AABC, NEBB or TABB** as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by **Engineer**.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## 1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

A. Notice: Provide **seven** days' advance notice for each test. Include scheduled test dates and times.

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- I. Examine system pumps to ensure absence of entrained air in the suction piping.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Isolating valves are open and control valves are operational.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

- B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, , and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Check for airflow blockages.

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
  - 3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors.
- B. Adjust air inlets for refrigerant exhaust to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than the dampers at air terminals.

### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare schematic diagrams of systems' "as-built" piping layouts.
- B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Set system controls so automatic valves are wide open.
3. Check pump-motor load.
4. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and comply with requirements in Section 232123 "Hydronic Pumps."
  2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
    - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
  3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- C. Check settings and operation of each safety valve. Record settings.

### 3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.9 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
  - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
  - 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
  - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
  - 4. Kilowatt and steam input if factory-installed instrumentation is furnished for measuring.
  - 5. Capacity: Calculate in tons of cooling.

### 3.10 PROCEDURES FOR COOLING TOWERS

- A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
  - 1. Measure condenser-water flow to each cell of the cooling tower.
  - 2. Measure entering- and leaving-water temperatures.
  - 3. Measure wet- and dry-bulb temperatures of entering air.
  - 4. Measure wet- and dry-bulb temperatures of leaving air.
  - 5. Measure condenser-water flow rate recirculating through the cooling tower.

### 3.11 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
  - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
  - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  - 3. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
  - 1. Balance each air inlet.

### 3.12 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Exhaust Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
  3. Cooling-Water Flow Rate: Plus or minus 10 percent.

### 3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
  2. Field test reports prepared by system and equipment installers.
  3. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Engineer's name and address.
  6. Contractor's name and address.
  7. Report date.
  8. Signature of TAB supervisor who certifies the report.
  9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  10. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  11. Nomenclature sheets for each item of equipment.
  12. Notes to explain why certain final data in the body of reports vary from indicated values.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Position of balancing devices.
  6. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  7. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- E. Chiller Reports: As required per this section and section 236416 “Centrifugal Water Chillers.”
- F. Cooling Tower Reports: As required per this section and section 236500 “Cooling Towers.”
- G. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in gpm.
    - g. Water pressure differential in feet of head or psig.
    - h. Required net positive suction head in feet of head or psig.
    - i. Pump rpm.
    - j. Impeller diameter in inches.
    - k. Motor make and frame size.
    - l. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. Full-load amperage and service factor.
    - p. Seal type.
  2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

H. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

END OF SECTION 230593

## SECTION 230716 - HVAC EQUIPMENT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
  - 1. Chillers.
  - 2. Chilled-water pumps.
  - 3. Steam condensate pumps.
  - 4. Steam moisture separators.
- B. Related Sections:
  - 1. Section 230719 "HVAC Piping Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail removable insulation at equipment connections.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.
  - 5. Detail field application for each equipment type.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Equipment Insulation Schedule" article for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534 Type II for sheet materials.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Sheet and K-FLEX LS.
- E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied ASJ with fact. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; CertaPro Commercial Board.

- b. Fibrex Insulations Inc.; FBX.
  - c. Johns Manville; 800 Series Spin-Glas.
  - d. Knauf Insulation; Insulation Board.
  - e. Manson Insulation Inc.; AK Board.
  - f. Owens Corning; Fiberglas 700 Series.
- F. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
1. For use on high pressure (125#) steam.
  2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fibrex Insulations Inc.; FBX.Industrial Insulation Group (IIG); MinWool-1200 Industrial Board.
    - b. Rock Wool; Delta Board.
    - c. Roxul Inc.; RHT and RockBoard.
    - d. Thermafiber, Inc.; Thermafiber Industrial Felt.
- G. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ramco Insulation, Inc.; Super-Stik.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.4 SEALANTS
- A. Joint Sealants:
- B. Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
- b. Eagle Bridges - Marathon Industries; 405.
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
- d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: White.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  - d. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.7 TAPES

### A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.8 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, - 0.135-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
    - 2) GEMCO; Peel & Press.
    - 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy .

## 2.9 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
1. Testing agency labels and stamps.
  2. Nameplates and data plates.

### 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
  2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.
  4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    - f. Impale insulation over anchor pins and attach speed washers.
    - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing

insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with fiberglass insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Secure the box sections together using a latching mechanism or self-tapping screws.
2. Fabricate boxes from aluminum, at least 0.060 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.
4. Extend grease fittings to accessible location on exterior of metal box.

### 3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Do not field paint aluminum jackets.

### 3.7 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Chillers:
  - 1. Insulate cold surfaces on chillers, including, but not limited to evaporator bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following, and provide vapor barrier:
    - a. Flexible Elastomeric: 1-1/2 inches thick.
    - b. Cover with aluminum jacketing.
    - c. Arrange for water box removal without insulation system replacement (similar to pump box.).
  - 2. Insulate hot surfaces on chillers, including but not limited to turbine, condenser, steam condenser, exhaust piping and control valve body with the following:
    - a. Calcium silicate or Cellular Glass: 1-1/2 inches thick, or with removable insulation.
    - b. Arrange for water box removal without insulation system replacement (similar to pump box.).
- D. Chilled-water pump insulation shall be the following, and provide vapor barrier:
  - 1. Mineral-Fiber Board: 2-1/2 inches thick and 4-lb/cu. ft. nominal density.
- E. Condenser-water pump insulation shall be the following:
  - 1. No insulation.
- F. Steam condensate pump insulation shall be the following:
  - 1. Mineral-Fiber Board: 2-1/2 inches thick and 6-lb/cu. ft. nominal density.
- G. Steam, moisture-separator, shall be the following:
  - 1. Mineral-Fiber Board: 2-1/2 inches thick and 6-lb/cu. ft. nominal density.

### 3.8 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. All Equipment:

1. Aluminum, Corrugated: Minimum 0.016 inch thick, with moisture barrier.

END OF SECTION 230716

## SECTION 230719 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Chilled-water piping, indoors.
  - 2. Condenser-water piping,.
  - 3. Steam and steam condensate piping, indoors.
- B. Related Sections:
  - 1. Section 230716 "HVAC Equipment Insulation."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 3. Detail removable insulation at piping specialties.
  - 4. Detail application of field-applied jackets.
  - 5. Detail application at linkages of control devices.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General" and "Indoor Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Mineral-Fiber, Preformed Pipe Insulation:
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ramco Insulation, Inc.; Super-Stik.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 SEALANTS

- A. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    - d. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.7 TAPES

### A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.8 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

### B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

### C. Wire: 0.080-inch nickel-copper alloy.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- #### A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  1. Install insulation continuously through hangers and around anchor attachments.
  2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Testing agency labels and stamps.
  2. Nameplates and data plates.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):  
Install insulation continuously through walls and partitions.
- B. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

- A. Do not field paint aluminum jackets.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water, above 40 Deg F:

1. NPS 4 and Smaller: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
2. NPS 5 and Larger: Insulation shall be the following:
  - a. Mineral-Fiber Preformed Pipe, Type I, 2 inches thick.

- B. Condenser-Water Supply and Return: None.

- C. Steam and Steam Condensate:

1. NPS 2 and Smaller: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches thick.
2. NPS 2-1/2 to NPS 10: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I: 3 inches thick.
3. NPS 10 and Larger: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe, Type I: 3 thick.

- D. Hot and Cold Drain Pipes:

1. Same insulation type and thickness as connected system.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. All Piping:
  1. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION 230719

## SECTION 230800 - COMMISSIONING OF HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
  - 1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements.

#### 1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority – The Engineer will act as the CxA for this project.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

#### 1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the Engineer.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.

- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Engineer.
- E. Provide information requested by the Engineer for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- G. Provide project specific equipment startup checklists for the Engineer's review.

#### 1.6 ENGINEER'S RESPONSIBILITIES

- A. Assemble project-specific construction checklists (provided by contractor) and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Provide test data, inspection reports, and certificates in Systems Manual.

#### 1.7 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the Engineer for inclusion in the commissioning plan:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
  - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
  - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
  - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
  - 5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
  - 6. Test and inspection reports and certificates.
  - 7. Corrective action documents.
  - 8. Verification of testing, adjusting, and balancing reports.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TESTING PREPARATION

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments to record test data as directed by the Engineer.

### 3.2 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Engineer.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, including some existing equipment, to demonstrate staging, failure modes, etc. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of controllers and sensors.
- D. The Engineer along with the HVAC&R [**Contractor**] [], testing and balancing [] [**Subcontractor**], and HVAC&R Instrumentation and Control [] [**Subcontractor**] shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.

- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Engineer and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The Engineer may direct that set points be altered when simulating conditions is not practical.
- H. The Engineer may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the University. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

### 3.3 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls." Assist the Engineer with preparation of testing plans.
- B. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R **Contractor** shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
  - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
  - 2. Description of equipment for flushing operations.
  - 3. Minimum flushing water velocity.
  - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- C. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, and pump systems. The Engineer shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

END OF SECTION 230800

## SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for equipment not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Section 230519 "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
  - 2. Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.
- C. In general, the existing plant sequences of operations shall remain as-is and shall be extended to accommodate the equipment installed under this project.
- D. This project includes an expansion of the existing Allen Bradley PLC based control system. Modifications and additions will be made to existing graphics and I/O cabinets so that the equipment added to the plant will be displayed on the control system interface and will operate with the existing system and equipment seamlessly.

#### 1.3 DEFINITIONS

- A. I/O: Input/output.
- B. PID: Proportional plus integral plus derivative.
- C. RTD: Resistance temperature detector.

#### 1.4 SYSTEM PERFORMANCE

- A. Additions and modifications shall not discernibly (< 5%) affect the response or update times for the interface or for control loop execution.

## 1.5 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
- B. A control device numbering scheme has been developed for this project. Submittals for each device must include the assigned device no. (i.e. TI-10053).
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
  - 4. Details of control panel faces, including controls, instruments, and labeling.
  - 5. Schedule of valves including flow characteristics.
  - 6. System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.
    - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  - 7. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
  - 8. Controlled Systems:
    - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    - c. Written description of sequence of operation including schematic diagram.
    - d. Points list.
  - 9. Transmitters.
    - a. Pressure/differential limited to construction, type, connections, range, accuracy, turndown, electrical characteristics and process connections. Clearly indicate the entire model number for each transmitter provided to determine compliance with the Contract Specifications. The Contractor shall provide dP span calculations for the expected nominal design condition. Completed ISA data sheets shall be submitted for each device. Provide factory calibration certificate for each transmitter.
    - b. Temperature transmitters: Manufacturer's product data for each type of device including but not limited to construction, type, connections, range, accuracy,

- turndown, electrical characteristics and process connections. ISA data sheets shall be provided for each device. Clearly indicate the entire model number for each transmitter and sensor assembly provided. Provide manufacturers information regarding the entire temperature sensor assembly. Sufficient information shall be provided to determine compliance with the Contract Specifications. Provide factory calibration certificate for each transmitter.
- c. Thermowells: Provide manufacturer's harmonic analysis of each unique thermowell application (each pipe size with a common maximum velocity), to document that no installation represents a risk of failure at the specified insertion distance.
10. Control Valves: Manufacturers product data for each valve and associated accessories (actuators, positioners, position switches, etc) with all of the features specific to the valve being provided highlighted. Provide assembly type drawings for each valve. Provide assembly type drawing each valve Clearly indicate the entire model number for each valve and accessory provided. Provide ISA data sheet for each control valve with all applicable information complete.
  11. Flow Meters
    - a. Completed ISA Data Sheet each flow meter.
  12. Switches: Provide manufacturers product data for each type of switch including but not limited to construction, type, connections, range, accuracy turndown electrical characteristics and process connections.
  13. Field Device Location Drawing
    - a. Contractor shall prepare a device location drawing that shows the locations of all control devices provided for this project. A/E shall provide electronic copy of general arrangement drawings to facilitate this process.
  14. Regulators: Provide manufacturer's product data for all regulators/filters.
  15. Control Tubing: Provide manufacturers product data for all tubing.
  16. Maintenance data for control systems equipment to include in the operation and maintenance manual specified in Division 1. Include the following:
    - a. Maintenance instructions and spare parts lists for each type of control device and compressed-air stations.
    - b. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
    - c. Calibration records, list of set points, and calibration interval.
  17. Spare Parts List: Submit a list of recommended spare parts and recommended quantities for all devices and equipment, with itemized unit pricing for each component. University will select number of each item to be purchased (outside the contract.)

## 1.6 QUALITY ASSURANCE

- A. All multiple quantities of the same item, whether of the same size or differing sizes shall be by the same manufacturer unless otherwise specified and where applicable the same model number.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.
- C. It shall be the responsibility of the Contractor to receive and store all instrument hardware items. Contractor shall visually inspect each item for damage and compliance with the specification. Items that are damaged shall be promptly returned to the manufacturer for repair or replacement. The return of these items to the job site shall be expedited to prevent any delay in system operation or start-up. Contractor shall properly store all instruments received in such a manner as to be easily accessible for inventory and control.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 CONTROL SYSTEM

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

#### 2.3 ELECTRONIC TRANSMITTERS

- A. Pressure/Differential Transmitters: Rosemount 3051 Series or equal by Yokogawa.
  - 1. General: Provide transmitters as indicated in the contract documents suitable for use with specified operating conditions.
  - 2. Construction: Construction shall be rugged type, designed for industrial applications with low sensitivity to vibration and shock. All process wetted parts (isolating diaphragm, drain/vent valves, process flanges and adapters) shall be 316 Stainless Steel. Wetted O-rings shall be Viton. The electronics housing shall be a low copper aluminum NEMA 4X enclosure. Cover O-rings shall be Buna-N.
  - 3. Electrical Design

- a. The transmitter shall operate with regulated DC power of 24 volts. Current requirements shall be maximum of 25 mA.
  - b. Transmitters shall have a load resistance effect less than plus or minus 0.10 percent of span per 1,000 ohm of load.
  - c. Output signal shall be 4 to 20 mA with Hart digital protocol. Output signal shall be analogous to pressure or differential pressure range.
  - d. Transmitter housing shall have 4 digital loop powered display which indicates process condition and units (i.e. 20 PSIG pressure.)
4. Performance Specifications:
- a. Accuracy (including combined effects of linearity, hysteresis, and repeatability) shall be as follows:
    - 1) Differential Pressure: Within plus or minus 0.075 percent of span.
    - 2) All other transmitters not indicated above 0.25 percent of span.
  - b. Linearity within plus or minus 0.1 percent calibrated span.
  - c. Hysteresis within plus or minus 0.005 percent of calibrated span.
  - d. Repeatability within plus or minus 0.05 percent of calibrated span.
  - e. Drift within plus or minus 0.2 percent of upper range limit per year.
  - f. Calibration: All transmitters shall be factory calibrated.
5. Connections: Process connections shall be 1/2 inch NPT. Provide side drain and vent. Electrical connection shall be 1/2 inch NPT with SCREW terminals and integral test jacket.
6. Smart Technology: All pressure and differential pressure transmitters supplied under this project shall have "Smart" technology via the Hart protocol. Communication shall allow identification of measured variables, tag number, range and span settings, device information and diagnostics and shall allow respanning calibration and maintenance between the PCS and the transmitter. All devices required to perform this function shall be provided. Communication shall occur via a digital signal along the 4 to 20 mA signal and shall not interfere with the 4 to 20 mA process signal.
7. Tagging: Transmitter Tag No. as indicated on contract documents shall be permanently stamped on the transmitter nameplate. Tag shall be permanently attached to the transmitters. In addition provide aluminum identification tag per Division 15 Section "Mechanical Identification".
8. Accessories: Provide three valve manifold for all differential pressure transmitters. Manifold shall be constructed with a Type 316 stainless steel body and stem. Hand wheel and barrel shall be Type 304SS. Packing and seals shall be Teflon. Nominal rating of manifold shall be 3000 psi at 392 degrees F. Provide connections required to connect test equipment for instrument calibration and adjustment.
9. Mounting Brackets: Provide a bracket for mounting each transmitter on a 2-inch pipe. Bracket shall be constructed of carbon steel with carbon steel U-bolt. Bracket shall be coated with polyurethane paint. Provide bolts and nuts for flanges and adapters.

B. Temperature Transmitters: Rosemount 644 Series or equal by Yokogawa.

1. Provide transmitters as indicated in the contract documents suitable for use with specified operating conditions. Temperature transmitters shall be provided complete with sensor

- assembly and all required accessories. Sensor assembly and transmitter shall be manufactured and supplied by the same entity.
2. Construction: Construction shall be rugged type, designed for industrial applications with low sensitivity to vibration and shock. The electronics housing shall be a low copper aluminum NEMA 4X enclosure. Cover O-rings shall be Buna-N. Electrical connection shall be 1/2-inch NPT. Transmitter shall be compatible with a variety of temperature sensors, including 2, 3, and 4 wire RTD's, thermocouples, and other resistance and millivolt inputs.
  3. Electrical Design:
    - a. The transmitter shall operate with regulated DC power of 24 volts. Current requirements shall be a maximum of 25 mA.
    - b. Transmitters shall have a load resistance effect less than plus or minus 0.10 percent of span per 1,000 ohm of load.
    - c. Output signal shall be 4 to 20 mA with Hart digital protocol. Output signal shall be analogous to temperature range.
    - d. Transmitter shall be equipped with a 5 digital loop powered LCD display. Display options shall include engineering units in degrees F and milliamps. Display accuracy shall be +/- 0.5% calibrated span.
  4. Performance Specifications: Transmitter accuracy shall be minimum of +/- 0.25 deg. F including combined effects of linearity, hysteresis, and repeatability. Stability shall remain within plus or minus 0.1 percent of span for 24 months. All transmitters shall be factory calibrated.
  5. Mounting: Provide a bracket for mounting each transmitter on a 2-inch pipe. Bracket shall be constructed of carbon steel with carbon steel U-bolt. Bracket shall be coated with polyurethane paint. Provide bolts and nuts for flanges and adapters. Where approved by government transmitters can be direct mounted to sensor assembly.
  6. Tagging: Transmitter Tag No. as indicated on Data Sheets and bid documents shall be permanently stamped on the transmitter nameplate. Tag shall permanently be attached to the transmitter.
  7. Smart Technology: All temperatures supplied under this project shall be Smart via the Hart Protocol. Communication shall allow identification of measured variables, tag number, range and span settings, device interrogation and diagnostics, and shall allow respanning, calibration and maintenance between the PCS and the transmitter. Communication shall occur via a digital signal along the 4 to 20 mA signal and shall not interfere with the 4 to 20 mA process signal.
  8. Sensor Assembly:
    - a. Sensor Type: Platinum four wire 100 ohm RTDs. RTDs shall have a terminal block.
    - b. Spring Loaded Assembly
    - c. Sheath Material: 304SS
    - d. Installed length shall be selected by Contractor to suit specific line size.
    - e. Standard Type 304SS extension shall be provided, where required.
  9. Thermowells
    - a. All thermowells shall be threaded tapered style.
    - b. Thermowell length shall be selected by Contractor such that thermowell externals 30 to 50% into the process stream.

c. Material: 304SS

## 2.4 CURRENT TO PRESSURE (I/P) TRANSDUCERS

- A. Construction: Construction shall be rugged type, designed for industrial applications, with low sensitivity to vibration and shock. Electronics housing shall be low copper aluminum with NEMA 4X rating and painted with epoxy polyester or polyurethane paint. Provide inlet and outlet air gages.
- B. Design: The I/P transducer shall convert a 4 to 20 mA DC current input to a proportional output of pressure range required. If required, a split range input of 4 to 12 mA or 12 to 20 mA shall be provided. Maximum air consumption shall be 0.20 SCFM at 20 PSIG supply pressure. Operating temperature limits shall be 40 to 185 degrees Fahrenheit.
- C. Smart Technology: All I/P transducers supplied under this project shall be Smart via the Hart protocol. Communication shall allow identification of measured variables, tag number, range and span settings, device information, and diagnostics, and shall allow respanning, calibration, and maintenance between the PCS and the transducer. All devices required to perform this function shall be provided. Communication shall occur via a digital signal along the 4 to 20 mA signal and shall not interfere with the 4 to 20 mA signal.
- D. Air Filter: Provide an air filter upstream at each I/P device.
- E. Pressure Regulator: Provide regulator where required upstream at each I/P device.

## 2.5 PRESSURE SWITCHES

- A. Differential pressure switches shall be diaphragm operated to actuate two single pole double throw micro snap switches. Motion of each switch actuating piston shall be restrained by a spring that can be adjusted to set the exact pressure at which the switch will be actuated. Motion of the diaphragm shall be transmitted to each switch sequentially through concentric pistons.
  - 1. Temperature Limits: 275°F
  - 2. Operating pressure: 150 psig.
  - 3. Pressure connection: 1/4" NPT female.
  - 4. Electrical rating, switches: 10 amps, 125/250 VAC, 60 Hz. Two SPDT switches.
  - 5. Wire: 18 gauge leads, 18" long.

## 2.6 CONTROL VALVES

- A. Control Valve General Requirements:
  - 1. Each valve shall have a permanently attached stainless steel tag containing the stated tag number (I.E. FCV 01-10061) of the device per Division 23 Section "Mechanical Identification".

2. Positioners shall be provided on all modulating actuators. Provide electronic to pneumatic positioners for all valves that have an electronic signal input per the PCS I/O Schedule.
  - a. Construction: Construction shall be rugged type designed for industrial applications, with low sensitivity to vibration and shock. Electronics housing shall be low copper aluminum with a NEMA 4X rating and painted with epoxy polyester or polyurethane paint. Provide inlet and outlet air gages.
  - b. Design: The positioner shall convert a 4-20 mA DC current input signal to a proportional range as required to operate the control valve.
  - c. Smart Technology and Diagnostics Package: All positioners shall be Hart protocol "Smart" digital valve communicating controllers which use feed back of the valve travel position to diagnose the position controller, valve and actuator. Communication shall allow identification tag number, device information, and self diagnostics, and shall allow maintenance between the PCS and the positioner. The controller shall allow loop check on-line, automatically calibrate travel, automatically tune controller, and verify the dynamic response to input changes. The controller shall allow tracking of current, actuator pressure, and travel. Self diagnostic capabilities shall check valve performance by comparing the percent signature (bench set, seat load friction etc) against stored signatures to discover performance changes prior to them becoming significant to affect the process. All devices required to perform this function shall be provided. In addition, the position indication for all valves in terms of percent open shall be relayed and indicated to PCS. Provide a separate device if necessary to provide this feature. Communication shall occur via a digital signal along the 4 to 20 mA signal and shall not interfere with the 4 to 20 mA signal.
3. Actuators shall be sized to fully hold the valve against the maximum process differential pressure and spring rate with air to the actuator. If not explicitly stated maximum process differential pressure is to be determined at an upstream pressure 10 percent above maximum inlet pressure and the downstream pressure at atmospheric.
4. Combination Pressure Reducing Valve/Filter Assembly: Combination air filter-regulators shall be provided for each device utilizing instrument air and/or as indicated and shall have one common inlet/outlet for both filter and regulator, a calibrated pressure gage, and five micron-rated reusable element. The bowls shall be transparent with metal bowl guards, capable of operating at 150 PSIG and 125 degrees Fahrenheit, and shall be of the quick disconnect type. The standard pressure range shall be five to 125 PSIG. The regulator portion shall be of balanced valve design, diaphragm operated and self-relieving. The filter-regulators shall have 1/4 inch gage ports and automatic drains.
5. All accessories shall be yoke-mounted and completely tubed.
6. Unless otherwise specified, weld-on flanges are not acceptable and all valve flange face to face dimensions must conform to ANSI Standards.
7. All control valves shall be fully assembled with all accessories and functionally tested at the factory. This consists of connecting air and electricity, if required, and stroking the valve, pressurizing the control pneumatics, and checking proper operation of accessories such as positioners, solenoid valves, bypass valves, etc.
8. The following guidelines shall be used when sizing throttling control valves.
  - a. Maximum Flow at <85% Open
  - b. Normal flow at 40 - 70% Open
  - c. Minimum Flow at >20% Open

9. All electrical accessories shall have NEMA 4 housing, unless otherwise specified.
10. All accessories specified on the data sheet shall be supplied.
11. Solenoid valves, when specified, shall be rated for continuous duty, epoxy molded coil, 120 VAC operated, standard material rated for the service conditions unless otherwise specified on the data sheet.
12. Flow direction shall be permanently shown on valve body.
13. Unless explicitly specified, the manufacturer shall select the valve trim characteristic based on the individual service requirement for each valve.
14. The manufacturer shall calculate and submit the Cv required for each control valve based upon the given process conditions.
15. Each valve shall be furnished with a stainless steel nameplate showing:
  - a. Manufacturer's Name
  - b. Pressure Rating
  - c. Type
  - d. Serial Number
  - e. Inner Valve Size and Type
  - f. Valve Action
  - g. Valve Travel
  - h. Control Signal Pressure
  - i. Valve Tag Number

B. Control Valve Actuators

1. Control valve actuators shall be provided with the control valve as an entire package therefore keeping responsibility in the hands of the control valve supplier. The control valve manufacturer does not have to be the manufacturer of the actuator. Control valves shall arrive on-site with actuators already installed on the control valves. It is the responsibility of the control valve supplier to provide an accurately sized actuator.
2. Actuators shall be linear or rotary to suit the control valve style. Actuators shall be directly mounted on valve bodies. No three-bar linkages should be provided. The actuator shall have a visual position indicator.
3. Provide actuators sized to have a continuous torque as required by the application based on available 80 PSIG power air supply and operable without damage up to 150 PSIG air supply.

C. Butterfly Valves and Accessories.

1. High Performance (HP) Butterfly Valves shall be as specified in Section 230523 "General-Duty Valves for HVAC Piping."
  - a. Valves shall comply with the following industry standards.

1) <b>ANSI B16.34</b>	Valve-Flanged, Threaded, and Welding Ends.
2) <b>ANSI B16.104</b>	Control Valve Seat leakage
3) <b>MSS SP-68</b>	High Pressure Offset Seat Butterfly Valves
4) <b>API 598</b>	Valve Inspection and Test.
5) <b>API 609</b>	Butterfly Valves - Lug --Type and Wafer-Type
2. Two Position Actuator

- a. General: All control accessories shall be provided with the valve by the valve supplier. All accessories shall be factory assembled and mounted on valve prior to shipment to job site. All valves and accessories shall be factory tested to verify proper operation.
  - b. Valve shall be equipped with a double-acting rack and pinion type actuator. Maximum air supply pressure required shall not exceed 80 psig.
  - c. Actuator shall be selected by supplier based on intended duty (flow, pressure and location)
  - d. Actuator shall be provided with solenoid valve.
3. Modulating Valves-Actuator:
- a. General: All control accessories shall be provided with the valve by the valve supplier. All accessories shall be factory assembled and direct mounted to valve prior to shipment to job site. All valves and accessories shall be factory tested to verify proper operation.
  - b. Valve shall be equipped with double-acting rack and pinion type actuator. Maximum air supply pressure required shall not exceed 80 psig.
  - c. Actuator shall be selected by supplier based on unloaded duty, flow pressure and location.
  - d. Positioner-All modulating valves shall be provided with positioner. Positioner shall be designed for use with double acting actuator provided. Positioner shall be FM approved. Refer to control valve general requirements for positioner.
4. Solenoid Pilot Valves
- a. Pilot valve shall be 4 way solenoid direct mounted to actuator (factory mounted). Valve shall be in a NEMA 4 enclosure. Solenoid voltage requirements shall be coordinated with contractor and supplier of PCS control system. Pilot valve shall be selected by valve manufacturer to match actuator and application.
5. Position Transmitter
- a. Provide in accordance with the control valve schedule.
6. Position Switch
- a. Position switch assembly shall be provided with two switches; ones with will be activated when the valve is opened; one will be actuated when the valve is closed. Switch shall have the ability to be adjusted so that it can be actuated at any specific intermediate position. Switch type shall be SPDT mechanical type. Visual indicator shall be Red for closed/Green for open.
7. Decultchable Manual Override
- a. Provide side declutchable manual override on all butterfly valves. It shall consist of a manual gear actuator mounted between the actuator and the valve. The device shall be normally disengaged from the shaft.

2.7 INSTRUMENT AIR LINES

- A. The main instrument air headers with root valves are shown on mechanical drawings. Instrument air branch lines from these headers are not shown and shall be field run. The initial horizontal run shall be a minimum half inch diameter line (with root valve) terminating with a plugged tee and having drop lines from it, sizes as follows:

No. of Instruments Supplied From One Branch Line	Branch Line Size
1 to 2	1/4" NPS Pipe or 3/8" OD Tube
Up to 5	3/8" NPS Pipe or 1/2" OD Tube
Up to 15	1/2" NPS Pipe or 5/8" OD Tube
Over 15 Instruments	1" NPS Pipe or 1-1/8" OD Tube

No. of Control Valves Supplied From One Branch Line		Branch Line Size
Diaphragm	Piston	
1	1	1/4" NPS Pipe or 3/8" OD Tube
3	2	3/8" NPS Pipe or 1/2" OD Tube
Up to 6	4	1/2" NPS Pipe or 1-1/8" OD Tube
Over 6 Valves	Over 4 Valves	1" NPS Pipe or 1-1/8" OD Tube

- B. Instrument air subheaders from root valves to individual supplies 1 inch and greater shall be per Division 23 Section "Compressed Air Piping." All control tubing 7/8 inch and smaller shall be in accordance with Paragraph CONTROL TUBING specified in this Section.
- C. Branch lines shall be connected to the supply headers at the top of the pipe.
- D. Individual air filters, air pressure reducing valves with built in relief valve, and 2-inch diameter pressure gages shall be supplied by the Contractor for each instrument.
- E. Main and branch air supply headers shall have blowdown lines and valves at every low point, with a minimum of one blowdown per building elevation. These are to be 1/2-inch nominal pipe with gate valves 48-inches above the floor.

2.8 CONTROL TUBING

- A. All tubing shall be seamless, fully annealed, stainless steel tubing conforming to ASTM A 269, Grade TP 316. The ends shall be plugged before shipment. Outside diameter and wall thickness shall be as follows:

1/4	Inch Outside Diameter by 0.028 Inch Wall
3/8	Inch Outside Diameter by 0.032 Inch Wall
1/2	Inch Outside Diameter by 0.035 Inch Wall
5/8	Inch Outside Diameter by 0.042 Inch Wall

3/4	Inch Outside Diameter by 0.049 Inch Wall
7/8	Inch Outside Diameter by 0.058 Inch Wall
1	Inch Outside Diameter by 0.065 Inch Wall
1-1/4	Inch Outside Diameter by 0.083 Inch Wall
1-1/2	Inch Outside Diameter by 0.095 Inch Wall
2	Inch Outside Diameter by 0.120 Inch Wall

- B. Fittings shall be flareless compression Type 316 stainless steel. Approved fittings are as follows:

CPI	by Park-Hannifin
SWAGELOK	by Swagelock
TYLOK	by Tylok International

- C. Joints shall be made up in strict accordance with manufacturer's instruction.

## 2.9 INSTRUMENT SUPPORTS

- A. Transmitters: Instrument stands shall be provided for all transmitters. Stands shall be provided in accordance with Contract Documents.

## 2.10 CONTROL WIRING AND CABLE

- A. Electric Wire and Wiring Devices for Control Wiring: Refer to Division 26.
- B. Electronic and fiber-optic cables for control wiring are specified in Section 271500 "Communications Horizontal Cabling."

## 2.11 REFRIGERANT LEAK DETECTION SYSTEM

- A. Infra-Red (IR) Refrigerant Gas Sensor:
1. Provide Genesis International, Inc. model Sherlock IR Refrigerant Gas Sensor for R-134a.
- B. Audible/Visual Alarm:
1. Provide Genesis International, Inc. model Sherlock Horn and Strobe Assembly with Blue lens.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Installation

1. All controls, control devices, control wiring, and control piping shall be installed in accordance with the contract drawings and manufacturer's recommendations. The Contractor shall install all control wiring and piping from field devices to I/O panels to provide a fully operational system in accordance with the requirements of this Section. All control wiring and conduit shall be field routed.
2. The installation of all equipment shall be in strict accordance with manufacturer's instructions and installation book.
3. It is intended that, in general, the Contractor will be responsible for all control sequences, both pneumatic and electronic.
4. All conduit, wiring, control air tubing, etc., to accomplish the sequence of operation in this Division, shall be provided under this section. All electrical work performed under this section shall comply with the National Electric Code and Underwriters Laboratories where applicable, and shall be installed by licensed journeyman electricians.

### 3.2 INSTRUMENT INSTALLATION

- A. General: All personnel shall be skilled in the work to which they are assigned and all work shall be performed under the direct supervision of an experienced and competent foreman. Calibration sheets shall be filled out for each piece of equipment that is calibrated and a copy turned over to University for permanent records.
- B. The Contractor shall furnish all instruments including pipe, tubing, manual valves, supports, pipe and tube fittings, wire, conduit, tray, terminators, racks, mounting stands, mounting plates, etc., to complete a working and operable plant in accordance with these specifications.
- C. Workmanship: All work shall be constructed plumb, square, level and true to building lines and surfaces. Work shall be neat, substantial workmanlike so as to properly serve the intended purpose.
- D. Manufacturer's Recommendations: All instruments and instrument materials shall be installed in strict accordance with the manufacturer's recommendations and the applicable ASME, ISA or IEEE standards. Copies of manufacturer's instructions shall be shipped with each instrument for the Contractor's use. Should a conflict occur between the manufacturer's recommendations and the information contained in the contract documents, the Contractor shall request clarification by the Designer.
- E. Support of Field Mounted Instruments: The final location of field instruments shall be determined by the Contractor in the field. Prior to any work, the Contractor shall verify the final location of field mounted instruments with the University. Devices shall be securely supported on stands, plates or heavy brackets heavy enough not to vibrate or move excessively. Instrument supports shall not be mounted on or connected to handrails, stairways, machine bases, plant piping or any component subject to severe vibration, sway, or movement under load. All instruments unless specifically noted on Contract Drawings, shall be located in a manner and at an elevation that permits convenient access for calibration and maintenance (approximately 4'-0' above finished floor). Instruments shall be mounted in such a way as to prevent interferences with equipment, equipment maintenance, building structure, passageways, etc.

- F. Holes and Openings: Where holes are necessary in floors, walls, and siding, the Contractor shall neatly and carefully cut holes or openings of sizes approved by the Designer's representative. Where concrete slabs are already in place, cutting shall be performed in a manner not producing spalling of masonry or over break. Openings in walls and siding shall be sealed by the Contractor after piping and tubing is in place.
- G. Installation Verification: The Contractor shall visually inspect all instrumentation to determine that each piece has been installed in accordance with the contract documents and the manufacturer's recommendations: The following shall be inspected:
  - 1. Instrument Mounting
  - 2. Air Supply
  - 3. Signal Tubing
  - 4. Wiring
  - 5. Piping
- H. Upon completion of this inspection, the Contractor shall submit to the Engineer a letter indicating that all of the instrumentation has been installed in accordance with the contract documents.

### 3.3 CALIBRATION AND LOOP CHECKING

- A. General: The Contractor shall provide all labor supervision, services, tools, special equipment and consumable supplies required to perform a bench checkout of all instrumentation. The purpose is to provide initial acceptance tests and recorded data that can be used as a bench mark for future routine maintenance and trouble shooting. The goal is to ensure minimal instrument and control related start-up problems.
- B. Factory calibrated instruments, which are provided with factory calibration certificates, do not require field calibration. Provide field verification of factory calibration.
- C. The Contractor shall calibrate all instruments over the full operational range and prove instruments to be within the specified accuracy. The instruments shall be calibrated individually and where applicable as a system. A minimum of five points shall be checked during calibration (0%, 25%, 50%, 75% and 100% range). After each span adjustment the zero point shall be rechecked. All test equipment used shall be certified within the past year.
- D. The Contractor shall advise the Engineer in writing upon failure of any equipment or material to pass the test performed by the Contractor, or to properly function, as intended, or to meet the calibration accuracy required. The Engineer shall direct the Contractor in taking the necessary steps to correct the failure. All equipment and materials provided by the Contractor requiring correction shall be corrected at his expense.
- E. After the instrument has been calibrated, all pertinent valves and switches shall be positioned and tagged as needed for protection, and a distinctive tag or label shall be affixed to the instrument to indicate that it has been calibrated. Include the date and technicians name.
- F. Documentation

1. The Contractor shall be responsible for preparation and distribution of certified copies of forms recording and documenting the results of all calibrations. The Contractor shall maintain a current record of calibration and loop checkout in order to permit informing the University, upon request, of exact status of the calibration and checkout.
2. Submit calibration procedures to University for review and approval, prior to starting work.
3. The Contractor shall submit, for the University's record, calibration procedures for all instrumentation and control devices.

G. Personnel Qualification:

1. The Contractor shall perform the work with technicians skilled in this particular type of work and with supervision thoroughly knowledgeable in calibration and loop checking of instruments in large industrial facilities.

H. Compatibility of Calibration Medium

1. All fluids introduced to instrument bodies and attached piping for purpose of calibration, or any other purpose, shall be compatible with the fluid in which instrument and piping will be filled during normal operation, and shall be free of system contaminants.

I. Loop Checkout

1. The Contractor shall provide all labor and supervision for the pre-operational tests of each control loop and of each control system. Upon completion of the loop checkout, the Contractor shall submit to the Engineer a check list indicating that all of the control loops have been checked and operate as required by the contract documents. At a minimum, the check list shall include the Loop No., date checked, and initials of person performing loop check.
2. All control loops shall be individually operated before start-up. Permissive interlocks shall be actuated or positioned temporarily to prove the proper operation of each control loop. Actual signals must be introduced into the normal loop sensors unless specifically waived by the Engineer in favor of mechanical movement of such devices. Prior to energization of instrument loops, the Contractor shall ensure that all power, control, and signal circuits containing fuses are checked for the presence of fuses of the proper type and size.

### 3.4 ELECTRICAL WIRING AND CONNECTIONS

- A. Control Contractor shall be responsible for field wiring of all field devices and remote equipment control panels to the plant control system.
- B. Install raceways, boxes, and cabinets according to Division 26.
- C. Install building wire and cable according to Division 26.
- D. Install signal and communication cable according to Division 26 and 27.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  2. Install exposed cable in raceway.
  3. Install concealed cable in raceway.
  4. Bundle and harness multiconductor instrument cable in place of single cables where a number of cables follow a common path.
  5. Fasten flexible conductors, bridging cabinets and doors, neatly along hinge side; protect against abrasion. Tie and support conductors neatly.
  6. Instrument bonding shall be installed in accordance with the manufacturer's recommendations.
  7. Number-code or color-code conductors for future identification and servicing of control system.
- E. Connect electrical components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- F. Connect manual reset limit controls independent of manual control switch positions.
- G. Connect HAND-OFF-AUTO selector switches to override automatic interlock controls when switch is in HAND position.

### 3.5 REFRIGERANT LEAK DETECTION SYSTEM

- A. Mount the IR sensor 18 to 24 inches above finished floor, per manufacturer's recommendations for R-134a.
- B. Mount the IR sensor in an orientation per manufacturer's recommendations and as indicated on drawings.
- C. Mount the Audible/Visual alarm 72 to 96 inches above finished floor, directly above IR sensor.
- D. Connect IR sensor to existing Genesis International, Inc. model Sherlock 404 refrigerant gas monitoring system control module.
- E. Contractor shall update front-end programming to recognize additional sensors.
- F. The existing audio/visual alarm units are existing to remain and shall be verified for functionality after connection of new sensors.

### 3.6 WARRANTY

- A. Provide a one year full parts and labor warranty for all control systems and equipment. The warranty shall extend one (1) year from the date of final acceptance or payment (whichever is later) by the University. During the warranty period the Contractor shall perform all required periodic equipment maintenance and calibration.

### 3.7 EXAMINATION

- A. Verify that power supply is available to control units.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

### 3.8 INSTALLATION

- A. Extend instrument air from existing source; provide pressure gages and shutoff valves.
- B. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."
- C. Install hydronic instrument wells, valves, and other accessories according to Section 232116 "Hydronic Piping Specialties."
- D. Install steam and condensate instrument wells, valves, and other accessories according to Section 232216 "Steam and Condensate Piping Specialties."

### 3.9 PNEUMATIC PIPING INSTALLATION

- A. Install piping in mechanical equipment rooms inside mechanical equipment enclosures, in pipe chases, or suspended ceilings with easy access.
  - 1. Install stainless steel or copper tubing with maximum unsupported length of 36 inches, for tubing exposed to view.
- B. Install tubing with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Purge tubing with dry, oil-free compressed air before connecting control instruments.
  - 1. Bridge cabinets and doors with flexible connections fastened along hinge side; protect against abrasion. Tie and support tubing.
- D. Number-code or color-code control air piping for future identification and service of control system, except local individual room control tubing.
- E. Pressure Gages or Test Plugs: Install on branch lines at each receiver controller and on signal lines at each transmitter, except individual room controllers.

### 3.10 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Pressure test control air piping at 150 psig or 1.5 times the operating pressure for 24 hours, with maximum 1-psig loss.
5. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
6. Test each point through its full operating range to verify that safety and operating control set points are as required.
7. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
8. Test each system for compliance with sequence of operation.
9. Test software and hardware interlocks.

B. Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check system as follows:
  - a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - b. Verify that controllers are protected from power supply surges.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and controls for a minimum of one 8-hour day. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 230900

## SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Section 230900 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

#### 1.3 DEFINITIONS

- A. PCS: Plant Control System – the Allen Bradley PLC based control system that monitors and controls all mechanical systems in the plant and includes operator interfaces with graphic screens, workstations and a historian.
- B. HMI: Human Machine Interface – a graphical monitoring and input control station.

#### 1.4 COOLING (CONDENSER) WATER SYSTEM

- A. Existing Summer and Winter Modes:
  - 1. The intent is to incorporate the equipment added in the current scope of work in the current operating procedures.
  - 2. Summer – Manual inlet and outlet isolation valves on all operational cells remain open (i.e. water flows over all available towers)
  - 3. Winter – Cells 7, 8 and 9 (which are equipped with basin heating and heat tracing on branch piping) remain in service.
    - a. Remaining cells are manually isolated and drained.
    - b. Bypass valves on Cells 7, 8 and 9 cycle open if leaving CWS temperature (sensed at existing TT-101) falls below set point.
- B. Cooling / Condenser Water Pumps are started and stopped manually by the operator.
  - 1. The intent is to incorporate the constant speed cooling water pump added in the current scope of work in the current operating procedure.

2. Operator will start a constant speed cooling water pump before each steam turbine drive chiller comes on line.
3. Operator will stop a constant speed cooling water pump after each steam turbine drive chiller goes off line.
4. Refer to chiller start up and shut down sequence for additional information.
5. Existing controls modulate variable speed cooling water pumps according to auxiliary plant cooling system requirements.

C. Cooling Tower Fans are controlled manually or automatically.

1. The intent is to incorporate the variable speed cooling tower added in the current scope of work in the current operating procedure.
2. LOCAL/REMOTE switch on face of VFC:
  - a. If switch is in LOCAL position, fan speed is controlled at the VFC keypad.
  - b. If switch is in REMOTE position, fan speed is controlled from Plant Control System.
3. PCS Manual Mode:
  - a. Operator starts and stops fan and sets speed at a fixed value.
4. PCS Auto Mode:
  - a. PCS modulates all fans to operate at the same speed, to maintain CWS temperature (sensed at existing TT-101) at set point. (Set point is a variable offset from ambient wet bulb, depending on the firing rate of the cogeneration system's duct burners.)
  - b. If the fan speed command falls to 30%, the PCS will shut down the fan on the next cell in the sequence.
  - c. If the fan speed command rise to 80%, the PCS will shut down the fan on the next cell in the sequence.
  - d. The cell start/stop sequence is determined by the operator (via a matrix on an HMI screen.)

## 1.5 CHILLED WATER DISTRIBUTION PUMP SYSTEM

- A. The intent is to incorporate the variable speed chilled water pump added in the current scope of work in the current operating procedure.
- B. Chilled Water Pumps are started and stopped manually by the operator.
- C. On line chilled water pumps in the Cogen Plant (and secondary pumps in the CUP) modulate speed to maintain a differential pressure set point.
  1. If both plants are operating, the differential pressure at PDT-001 (across the CHW mains exiting the cogen plant) is maintained at 27 psid.
  2. If only one of the plants is operating, the set point at PDT-001 is reset between 15 psid and 27 psid, to maintain specific differential pressure set points. The control is selected

from the furthest from set point of 5 representative building interface differential pressures.

- D. If pump speed exceeds 95% the PCS prompts the operator to start a chilled water pump.
- E. If pump speed falls to 45% the PCS prompts the operator to stop a chilled water pump.

## 1.6 STEAM TURBINE DRIVE CHILLER SYSTEM

- A. The intent is to incorporate the equipment added in the current scope of work in the current operating procedures, with the following exceptions:
  - 1. Existing steam driven chillers are manual start, prompting the operator to monitor equipment, open valves and start pumps in the proper sequence and after required time delays.
  - 2. The chiller added in the current scope will be equipped with an automated start routine, which does not require operator input after an initial start command.
- B. The current operating procedure is for manual staging of chillers. The PCS does not prompt operators to start or stop a chiller system (based on plant load or % chiller load, for example.)
- C. Chiller start sequence (for steam turbine drive chiller #8)
  - 1. Operator manually starts a cooling water pump.
  - 2. Operator opens FV003D on cooling water inlet to chiller.
  - 3. Operator commands Chiller #8 to start via Chiller Control Panel or PCS; chiller initiates start sequence, per Fig. 5B of JCI Form 160.67-O2.
  - 4. After Control Panel ramps turbine up to 1000 rpm, Control Panel signals PCS (via Ethernet connection) to open evaporator inlet valve, FCV008.
  - 5. Control Panel ramps open main steam block valve to 4000 rpm turbine initial run speed.
  - 6. Control panel modulates turbine speed from 3200 to 4500 rpm, to meet leaving chilled water temperature set point.
- D. Chiller stop sequence (for steam turbine drive chiller #8)
  - 1. Operator commands Chiller #8 to stop (soft stop) via Chiller Control Panel or PCS; chiller initiates soft stop sequence, per Fig. 5B of JCI Form 160.67-O2.
  - 2. Control panel reduces turbine speed to 3200 to unload chiller and stabilize turbine.
  - 3. Control Panel closes main steam block valve.
  - 4. After turbine coastdown, Control Panel signals PCS (via Ethernet connection) to:
    - a. Close evaporator inlet valve, FCV008, after 90 second delay from coastdown,
    - b. Prompt operator to close FV003D on cooling water inlet to chiller, after a 6 minute delay from coastdown, and
    - c. Prompt operator to manually shut down a cooling water pump, after a 6 minute delay from coastdown.
  - 5. Control Panel automatically completes shuts down sequence for auxiliaries, per Fig. 5B of JCI Form 160.67-O2.

E. Chiller Leaving Water Temperature Control

1. Leaving water temperature set point signal is provided to the Chiller Control Panel (via Ethernet connection) from the PCS, in accordance with the recently implemented optimization scheme (which varies the leaving water set point between 40F and 42F, depending on ambient conditions and on cogen system duct burner firing rate.)

- F. Monitoring Points – the PCS shall monitor, trend and display the same operating points as are monitored on the original 3 steam turbine drive chillers (via Ethernet connection.)

1.7 COOLING WATER BLOWDOWN AND MAKEUP SYSTEMS

- A. Existing cooling water blowdown and makeup systems are existing to remain.

1.8 CHEMICAL WATER TREATMENT SYSTEMS

- A. Existing water treatment systems are existing to remain.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 230993

## SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Chilled-water piping.
  - 2. Condenser-water piping.
  - 3. Blowdown-drain piping.
  - 4. Air-vent piping.
  - 5. Safety-valve-inlet and -outlet piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Steel pipe and fittings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Other building services.
  - 2. Structural members.
- B. Welding certificates.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

#### 1.6 WELDING QUALITY ASSURANCE

- A. Welding Procedures: In the form of a submittal, the Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every welding procedure that he proposes. Procedures shall be developed for all metals included in the work. The procedures for making transition welds between different materials or between plates or pipes of different wall thickness shall be qualified. Qualification for each welding procedure shall conform to the requirements of ASME B31.1, and to this specification. The method for each system shall be fully described including the number of beads, the volts, the amperes, and the welding rod for various pipe thicknesses and materials. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be clearly referenced to the type of welding required for this project. These procedures shall be the same as those used for all pipe welder qualification tests, all shop welds, and all field welds. The Contractor shall provide Procedure Qualification Records for all proposed Welding Procedure Specifications (WPS).
- B. Welding Procedure Submittals: Submit the following:
1. Welding Procedure Specifications: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00006, QW-482 "Suggested Format for Welding Procedure Specification (WPS)".
  2. Procedure Qualification Records: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00007, QW-483 "Suggested Format for Procedure Qualification Record (PQR)".
- C. Welder Qualification:
1. WPs: Provide welder qualifications for each welder for each weld type. It is highly recommended that the Contractor use ASME Form E00008, QW-484 "Suggested Format for Manufacturer's Record of Welder or Welding Operation Qualification Tests (WPQ)." The WPs shall be performed under the witness of an independent agency. The witness shall be a representative of an independent testing agency, Authorized Inspector, or consultant, any of which must be approved by the National Certified Pipe Welding Bureau. The qualifying test segment must be a 2 inch nominal pipe size with wall thickness within range of the WPS. Tests position shall be "6G" per ASME Section IX.
  2. Evidence of Continuity: Welder qualifications must be current. If the qualification test is more than 6 months old, provide record of welding continuity for each welder. Record of welding continuity shall show that the welder in question has performed welding to the procedure in question without a 6 month continuous span of inactivity since the date that the welder qualification test was passed for the submitted welding procedure. Record of welding continuity shall include, at a minimum, the welder's employer name and address,

the date the welder qualification test was passed, and the dates indicating welding continuity including welding procedure for each date.

D. Weld Records:

1. For all welding within the scope of ASME B31.1, the Contractor shall submit for approval an administrative procedure for recording, locating, monitoring, and maintaining the quality of all welds to be performed on the project. This quality control document record shall include but not be limited to drawings and schedules identifying location of each weld by individual number, identification of welder who performed each weld by individual welder's name, stamp number, date, and WPS used.
2. After achieving qualification, but before being assigned work, each qualified person shall be assigned an identifying number by the Contractor that shall be used to identify all of his welds. A list of qualified persons with their respective numbers shall be submitted by the Contractor and shall be maintained accurately with deletions and additions reported promptly.
3. Upon completing a joint, the welder shall mark the pipe not more than 6 inches from the weld with the identifying number and the last two digits of the year in which the work was performed. Identification marks shall be made by using a rubber stamp or felt-tipped marker with permanent, weatherproof ink or other methods approved by the Architect/Engineer (A/E) that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at 3-foot intervals. Identification by die stamps or electric etchers will not be allowed. The markers are to be provided by the Contractor. Substituting a map of welds with welders' names shall not be acceptable.

E. Welder Pre-Qualification

1. All welders shall be pre-qualified for this project by having the first weld tested via radiographic (RT) method by the independent testing agency (ITA). Acceptance standards shall be in accordance with Paragraph 136.4.5 of ASME B31.1. The procedure shall be in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. The ITA shall submit the written procedure as described in Paragraph T-221 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. The ITA shall provide a report in accordance with Paragraph T-291 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. All persons performing and evaluating radiographic examinations shall be certified for NDT Level II RT as recognized by the ANST. A nationally certified Level III RT technician per ANST shall be on staff at the testing laboratory. A Corporate Level III RT without National Certification is not acceptable. These RT tests shall be used as the basis for the UT testing for the project. Welders shall do one weld and then have that weld tested and approved via RT before doing any more welding work. Maintain an active approved list with the University.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Chilled-Water Piping: 150 psig at **100 deg F**.
2. Condenser-Water Piping: 150 psig at **150 deg F**.
3. Condensate-Drain Piping: Equal to the pressure of the piping system to which it is attached and **150 deg F**.
4. Blowdown-Drain Piping: Equal to the pressure of the piping system to which it is attached and **200 deg F**.
5. Air-Vent Piping: Equal to the pressure of the piping system to which it is attached and **200 deg F**.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; electric resistance welded or seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- C. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. 1/8" thick, full face, Class 150 nonmetallic compressed sheet gasket with nitrile, SBR or neoprene binder, in conformance with ASME B16.5, Annex E and ASME B16.21, for flat face.
  2. Valves equipped with integral gaskets will not require gaskets specified herein.
  3. Gaskets supplied by equipment vendors may be used if they are the equivalent to gaskets specified herein.
  4. Flanges connecting dissimilar metals shall be separated by an insulating kit including dielectric gasket.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:

1. **Manufacturers:** Subject to compliance with requirements, **provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:**
  - a. A.Y. McDonald Mfg. Co.
  - b. Capitol Manufacturing Company.
  - c. Central Plastics Company.
  - d. Hart Industries International, Inc.
  - e. Jomar International, Ltd.
  - f. Matco-Norca.
  - g. Watts Regulator Co.
  - h. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.
2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: **150 psig.**
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric-Flange Insulating Kits:

1. **Manufacturers:** Subject to compliance with requirements, **provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:**
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: **150 psig.**
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Chilled-water piping, aboveground, 24" and smaller, shall be the following:
  1. Schedule 40 or schedule STD ERW or seamless steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- B. Condenser-water piping, aboveground, 24" and smaller, shall be the following:

1. Schedule 40 or schedule STD ERW or seamless steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- C. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- D. Air-Vent Piping:
  1. Inlet: Same as service where installed.
  2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

### 3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. 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.
- C. Install piping to permit valve servicing.
- D. Install piping at indicated slopes.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- J. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- K. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- L. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- M. 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.
- N. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."

- O. Install unions in piping, NPS 1 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- P. Install flanges in piping, **NPS 2-1/2** and larger, at final connections of equipment and elsewhere as indicated.
- Q. Install shutoff valve immediately upstream of each dielectric fitting.
- R. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

### 3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for **NPS 2** and Smaller: Use dielectric **unions**.
- C. Dielectric Fittings for **NPS 2-1/2 to NPS 4**: Use dielectric **flange kits**.
- D. Dielectric Fittings for **NPS 5** and Larger: Use dielectric flange kits.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet.
  - 2. NPS 1: Maximum span, 7 feet.
  - 3. NPS 1-1/2: Maximum span, 9 feet.
  - 4. NPS 2: Maximum span, 10 feet.
  - 5. NPS 2-1/2: Maximum span, 11 feet.
  - 6. NPS 3 and Larger: Maximum span, 12 feet or per ASME B31.1.
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. 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.
- D. 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/A5.8M.
- E. 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:
  1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. 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.
- F. Welded Joints: Construct joints according to ASME B31.1 and AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.6 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.1 and as follows:
  1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  3. 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.

4. 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.

B. 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 existing pipe system 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 the "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.
  - a. Hold system at test pressure for 2 hours; system is acceptable if loss is less than 2 psig, as witnessed by the University or the University's representative.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. 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).
4. Inspect and set operating temperatures of hydronic equipment, such as chillers, cooling towers, to specified values.
5. Verify lubrication of motors and bearings.

END OF SECTION 232113

## SECTION 232116 - HYDRONIC PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
  - 1. Chilled-water piping.
  - 2. Condenser-water piping.
  - 3. Air-vent piping.
  - 4. Safety-valve-inlet and -outlet piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for automatic flow-control valves.
  - 2. Air-control devices.
  - 3. Hydronic specialties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
1. Chilled-Water Piping: 150 psig at 100 deg F.
  2. Condenser-Water Piping: 150 psig at 150 deg F.
  3. Blowdown-Drain Piping: 150 deg F.
  4. Air-Vent Piping: 200 deg F.
  5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

### 2.2 VALVES

- A. Gate, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping.
- B. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Spence Engineering Company, Inc., Type D36 or comparable product by one of the following:
    - a. Watts Regulator Co.
    - b. Wilkins Operation of Zurn Industries.
  2. Valve shall meet A.S.S.E. Standard 1003.
  3. Body: Bronze ASTM B61-80 or Cast Copper Silicon Alloy.
  4. Valve Ends: Class 250 NPT
  5. Disc: Buna N, or EPDM.
  6. Seat: Replaceable stainless steel.
  7. Stem Seals: EPDM O-rings.
  8. Diaphragm: Buna N or reinforced EPDM, suitable for water service.
  9. Spring: Stainless steel
  10. Low inlet-pressure check valve. (Optional.)
  11. Inlet Strainer: Stainless steel screen, removable without system shutdown. (Optional.)
  12. Valve Seat and Stem: Replaceable stainless steel.
  13. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
    - a. Maximum Temperature: 160 degrees F
    - b. Inlet Pressure: 80 PSIG
    - c. Design Outlet Pressure: 70 PSIG
    - d. Maximum Working Pressure: 300 PSIG
    - e.
- C. Diaphragm-Operated Safety Valves: ASME labeled.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  - a. AMTROL, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

### 2.3 AIR-CONTROL DEVICES

#### A. Automatic Air Vents:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AMTROL, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump.
  - d. Nexus Valve, Inc.
  - e. Spriax Sarco
  - f. Taco, Inc.
2. Body: Steel.
3. Internal Parts: Replaceable. Stainless steel. Valve head shall be EDPM.
4. Operator: Stainless steel. Valve head shall be EDPM metal float.
5. Inlet Connection: NPS 3/4
6. Discharge Connection: NPS 3/8
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F.

#### B. Full Acceptance Bladder-Type Expansion Tanks:

1. **Manufacturers:** Subject to compliance with requirements, provide products by the following, or approved equal:
  - a. Wessels

2. Tank: Welded carbon steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Tank shall be fitted with lifting rings and floor mounting skirt for vertical installation. Factory test after taps are fabricated and supports installed and are labeled according to the most recent addendum of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Full acceptance, heavy-duty butyl. Removable. Fully compatible with water/glycol mixtures. Securely sealed into tank, preventing tank corrosion and waterlogging problems, by separating air charge from system water to maintain required system pressure.
4. Connections: NPT system connections. Provide taps for pressure gage (air side) and air-charge fittings, air release fittings, water fittings and drain fittings. All fill and drain fitting shall be provided by manufacturer with ball valve termination.
5. Air-Charge Fittings: Schrader valve (0.302"-32 charging valve connection), stainless steel with EPDM seats, to facilitate on-site charging of the tank.
6. Bladder Monitor: Provide tank with capacitive sensor bladder monitor with visual and audible alarm that activates based on excessive bladder movement.

## 2.4 HYDRONIC PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Body: Cast steel, suitable for 425°F and 600 PSIG. with bolted cover and bottom drain connection. Same size as pipe in which they are installed.
2. End Connections: Socket weld for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 1/8" opening, perforated stainless-steel basket with 50 percent free area.

### B. Suction Diffusers:

1. Spence Strainers International (SSI) Series FF fabricated suction diffuser, Flow Conditioning Corp double suction diffuser, or equal.
2. Body: A106, Class B, carbon steel with hinged, T-bolted cover and bottom drain connection.
3. End Connections: Flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: 40-mesh start-up mesh, and permanent 20 mesh weld to perforated stainless-steel basket with 50 percent free area with 1/8 inch openings.
5. CWP Rating: 150 psig.
6. Clean basket pressure drop shall not exceed 2 psid.

### C. T-Pattern Strainers:

1. Body: Straight flow and angle flow. Ductile or malleable iron with quick-opening covers with hinges for strainer maintenance.
2. End Connections: Flanged ends.
3. Strainer Screen: 1/8" opening, perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: Strainers shall be ANSI Class 150

## PART 3 - EXECUTION

### 3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- C. Install safety valves as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at equipment and elsewhere as required for air venting.
- B. Install expansion tanks on the floor in accordance with manufacturers recommendations. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system design requirements.
- C. Start Up Strainers
  - 1. Temporary strainers shall be removed after start-up.
- D. Strainers (Y-Type and Tee Type)
  - 1. Install strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection. Where indicated, provide drain line from shutoff valve to drain, full size of blow down connection.
  - 2. Temporary start-up screens shall be removed after start-up.
- E. Dielectric Unions and Flanges
  - 1. Install at each piping joint between dissimilar metal piping. Comply with manufacturer's installation instructions.
- F. Air Release Valves
  - 1. Install air release valves on each cooling water inlet and outlet water box on the chiller refrigerant condenser and chiller steam condenser and as shown on the drawings.
  - 2. Install an isolations ball valve at the inlet to the air release valve to permit servicing.
  - 3. Install a manual vent valve in parallel with each air release valve.

### 3.3 INSULATION, PAINTING AND IDENTIFICATION OF PIPING SPECIALTIES

- A. Insulate all pipe specialties in accordance with Section 230716 – HVAC EQUIPMENT INSULATION, and Section 230719 – HVAC PIPING INSULATION. Do not insulate moving parts unless insulation sleeves are provided.
- B. Provide equipment identification tags in accordance with Section 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT. Provide second identical manufacturer’s nameplate for insulated equipment. Permanently attach second nameplate at a visible location on exterior of insulation.

### 3.4 FIELD QUALITY CONTROL

- A. All pipe testing and inspection shall be in accordance with the requirements of this specification section and the requirements of Section 232113 – HYDRONIC PIPING.

### 3.5 ADJUSTING AND CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- B. Remove suction diffuser start-up screens after system flushing.
- C. Refer to Section 232113 – HYDRONIC PIPING for flushing hydronic piping systems.

### 3.6 COMMISSIONING

- A. Perform these steps before operating each system:
  - 1. Open valves to full open position. Close bypass valves.
  - 2. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or bleed air completely (manual type).
  - 3. Check operation of automatic valves.
  - 4. Complete and document all weld tests and hydrostatic tests.
  - 5. Check expansion tank (if applicable) to determine that it is not air bound and that system is completely full of water.

END OF SECTION 232116

## SECTION 232123 - HYDRONIC PUMPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes pumps for the cooling water system and chilled water system, including but not limited to:

1. Equipment and Materials

- a. Cooling Water Pumps and Chilled Water Pumps
- b. Lubrication oil, consumables, special tools and spare parts

2. Services

- a. Installation Services – Assist the Contractor in the supervision of the installation of the equipment.
- b. Laser shaft alignment.
- c. Commissioning and Startup Services - Inspect the installation prior to placing in service, supervise the start-up, check-out operations, and make adjustments to place the equipment in service.
- d. Acceptance Testing - Supervise the acceptance testing and performance testing. Issue the Performance Test Report.
- e. Service Contract.

NOTE: Any conflicts between the requirements of this specification and the applicable Codes and Standards or government rules and regulations shall be referred to the Engineer for clarification.

#### 1.2 REFERENCES

- A. Specification 23 05 13 - "COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT."
- B. State of Connecticut Building Code
- C. AFBMA - Anti Friction Bearing Manufacturer's Association
  - 1. AFBMA 9 "Load Rating and Fatigue Life for Ball Bearings"
  - 2. AFBMA 11 "Load Rating and Fatigue Life for Roller Bearings"
- D. ANSI - American National Standards Institute
- E. ANSI/HI-Hydraulic Institute
- F. ASME - American Society of Mechanical Engineers

- G. ASTM - American Society of Testing and Materials
- H. AWS - American Welding Society
- I. Hydraulic Institute Standards
- J. IEEE - Institute of Electrical and Electronics Engineers
- K. Instrument Society of America
- L. NEC-National Electric Code
- M. NEMA - National Electric Manufacturers Association
- N. OSHA-Occupational Safety and Health Administration
- O. SSPC-Structural Steel Painting Council
- P. UL- Underwriters Laboratory 778 "Motor Operated Water Pumps"

### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide pumps to operate at system fluid temperatures indicated on Drawings without vapor binding and cavitation, are non-overloading in parallel or individual operation with consideration given to efficiency throughout the required range of operation.
- B. Environment Conditions and Requirements
  - 1. Pumps will be located inside an environmentally controlled building. Temperatures will range between 40°F and 105°F.
  - 2. Noise: 91 dBA maximum at three feet from equipment and five feet above the floor.

### 1.4 SUBMITTALS

- A. Shop Drawings: The submittals quantity shall be: One (1) electronic, six (6) hard copy; and include, but are not limited to, the following:
  - 1. Equipment ID numbers on each sheet.
  - 2. Indicate components assembly, dimensions, cross sections and details, flange locations and connection allowable loads, required clearances, component pull-spaces and location and size of field connections and valves.
  - 3. Material specifications.
  - 4. Weight of equipment and distribution of the static, live and other loads.
  - 5. Component (valve, instrument, and specialty) lists.
  - 6. Complete Bill of Materials.
  - 7. Field Arrangement and Installation.
  - 8. Wiring Diagrams.
  - 9. Motor Data.
  - 10. Ground Connections.

- B. Product Data: Submit rated capacities, specialties and accessories, electrical requirements and wiring diagrams. The submittals quantity shall be: One (1) electronic, six (6) hard copy; and include, but are not limited to the following:
  - 1. Noise criteria and sound level data.
  - 2. Reference List of Connecticut area installations of similar equipment with over 2 years of current operation.
- C. Test Reports: Provide results of factory and field performance test.
  - 1. Submit certified pump curves showing performance characteristics and NPSHR curve from zero capacity to pump runout with pump and minimum, guarantee and maximum system operating points plotted. Provide pump performance for Variable Frequency Drive motor operation at 20%, 40%, 60%, 80%, 100% of rated speed.
  - 2. Submit certified pump curves for single pump operation.
  - 3. Submit certified pump curves for the selected, largest and smallest impeller design for the pump casing provided.
  - 4. Provide noise criteria and sound level data.
  - 5. Submit hydrostatic test report.
  - 6. Submit material conformance certificates.
- D. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit assembly, support details, connection requirements, and include start-up instructions. Include setting drawings with templates, directions for installing foundation and anchor bolts, and other anchorages. Submit laser alignment report.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements including components not produced by manufacturer.
- F. Manufacturer's Field Reports: Submit start-up report for each unit.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit six (6) sets of O&M manuals, start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
- B. Spare Parts List - Price list for recommended short and long term spare parts.

#### 1.6 QUALITY ASSURANCE

- A. Contractor shall have written Quality Assurance (QA) Program that details documentation and traceability procedures necessary to ensure compliance with these specification requirements. The complete QA program shall be available for review on request.
- B. All requirements of these Specifications shall be applied to all suppliers and subtier vendors used by the Contractor at any time during the design, fabrication and erection of the pumps and electric motors.

- C. It is the Contractor's responsibility to obtain copies of all documents referenced in these Specifications. Unless specific exception is requested formally by the Manufacturer, and formally granted by the Owner/Engineer, these referenced documents shall be binding.
- D. The Owner/Engineer reserves the right to inspect the product and audit materials and processes at any of the Contractor's facilities that are performing work in support of these Specifications. Products and services supplied under these Specifications are subject to the Owner/Engineer's final inspection, acceptance and release.
- E. Ensure products and factory installations of specific products are in conformance with Manufacturer's recommendations and requirements.
- F. No deviation of nonconformance with the requirements of these Specifications is acceptable unless approved in writing by the Owner/Engineer. Any work performed in an area affected by a deviation or nonconformance prior to written approval shall be at the Contractor's risk. Responsibility for compliance rests with the Contractor. The Owner/Engineer's exercise of or failure to exercise his right to inspect, witness, audit or failure to note a deviation or nonconformance shall not relieve the Contractor of his obligation to comply with all of the requirements.
- G. Single Source Responsibility: Obtain each category of pump (i.e. end-suction, etc) from one source and by a single manufacturer. Include responsibility and accountability to answer questions and resolve problems regarding compatibility installation and performance and acceptance of pumps.
- H. All electrical components, devices and accessories must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- I. Pump manufacturer shall be ISO 9000 Certified.

#### 1.7 QUALIFICATIONS

- A. Manufacturers Qualifications: The pump manufacturer shall provide pumps that are based on the manufacturer's standard product, except as specified herein. The Pumps provided shall have been the same model used in successful operation on five (5) similar installations of the same size and duty for a period of five (5) years or longer.
- B. Field Service Representative Qualifications: The manufacturer's representative shall be directly employed by the equipment manufacturer or the equipment manufacturer shall submit a signed letter on their letterhead indicating that the said representative is designed by the equipment manufacturer to perform installation inspection field tests and start-up services on the equipment manufacturer's behalf.
- C. Testing and maintenance: Company specializing in performing Work of this section with minimum three years' experience.

#### 1.8 PRE-INSTALLATION MEETINGS

- A. Attend a meeting with the installed one week prior to commencing pump installation.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Protect systems from entry of foreign materials by temporary covers.
- B. Provide shipping flange protective covers and protective coatings during outdoor storage.
- C. Identify any special storage requirements.
- D. Provide rigging instructions for handling.
- E. Long-term storage, if over three months shall follow manufacturer's recommendations.
  - 1. Dry pump internals and spray liquid end with water displacement rust preventative (DASCO ARC 404-A or equal).
  - 2. Enclose vapor phase inhibitor in pump internals (Olin Dichon 100 or equal)
  - 3. Coat exposed machined surfaces with firm film rust preventative (Rust Veto 342 or equal).
  - 4. Cement rubber diaphragms to flanges and cover with hardboard flange covers.
  - 5. Plug all tapped openings, coating threads with thread compound.
  - 6. Pump will be skidded for forklift handling and covered with a plastic sheet open on the bottom to allow breathing..

#### 1.10 EXTRA MATERIALS

- A. Manufacturer shall submit a recommended spare parts list with prices for both one (1) and five (5) year intervals. Spare parts list shall indicate a summary of the criticality of the various parts relative to the expected life of the part before failure, based on Manufacturer's experience. Spare parts list shall contain all drawing reference numbers, item numbers, part numbers, and/or catalog numbers necessary to identify spare parts.
- B. Contractor shall submit an estimated time to deliver, upon receipt of order, for spare parts.

### PART 2 - PRODUCTS

#### 2.1 CENTRIFUGAL PUMPS-GENERAL

- A. Provide centrifugal pumps for cooling water and chilled water application.
- B. Type: Horizontal shaft, single stage end suction, base mounted, oil lubricated, radial split casing.

- C. Casing: Ductile iron, with 316 cast iron side plate, drain plug, ANSI Class 150 flanged suction and discharge.
- D. Taper Bore Seal Chamber: Provide with particle ejection.
- E. Impeller: 316 stainless steel, open impeller, statically and dynamically balanced, keyed to shaft and secured with impeller nut. For pumps not frequency drive controlled, trim impeller to match specified performance.
- F. Bearings: Flood oil lubricated, antifriction bearings with a minimum life of 40,000 hours at design conditions per ANSI/AFBMA-9 or-11, with rating life L-10.
- G. Shaft: A322 4340 alloy steel with 316 stainless steel shaft sleeve completely covering the wetted area under the seal.
- H. Seal: Carbon rotating against stationary silicon carbide seat. Seals shall be mounted directly on the shaft and located so that seal lubrication is directed immediately over the seal faces. Mechanical seal shall be cartridge type, Chesterton model 180 code 1CDA, or equal.
- I. Drive Coupling: Flexible coupling with coupling guard. The coupling guard shall meet OSHA 1910.219 requirements, and ANSI B15.1.
- J. Baseplate: Fabricated steel with integral drain rim and drip pan extended from pump end back to a point underneath motor shaft extension. Drip pan shall have 3/4" BSP drain connection at pump end. Baseplate shall have 4" grout holes, vent holes and horizontal motor alignment screws. J-type or manufacturer's recommended foundation bolts shall be provided.
- K. Performance: Pump shall have a stable head / capacity curve that rises continuously to shutoff. The best efficiency point of the pump shall be within 10 percent of the design point.
- L. Testing: Each pump model shall be factory tested per Hydraulic Institute standards.
- M. Painting: Each pump shall be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment in accordance with the Manufacturer's standards.
- N. The impeller provided shall not be the largest impeller allowed for the pump casing. Pumps having impeller diameters larger than 85 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected.
- O. Each pump shall be supplied with a condition monitor that constantly measures vibration and temperature at the thrust bearing. Colored LED's indicate general pump health, providing early warning of improper operation before catastrophic failure occurs.

## 2.2 COOLING WATER PUMPS (CW-P006E)

- A. Pumps will be as described in Section 2.1.
- B. Provide Goulds model 3180 L, or approved equal.

- C. Refer to Reference A, specification 230513, "Common Motor Requirements for HVAC Equipment," for cooling water pump motors. The pump motor rating shall not be exceeded for any operating condition with pumps operating individually or in parallel.
- D. Refer to design criteria indicated on Drawings for cooling water pumps.

### 2.3 CHILLED WATER PUMPS (CHW-P004D)

- A. Pumps will be as described in Section 2.1.
- B. Provide Goulds model 3180 L, or approved equal.
- C. Refer to specification 230513, "Common Motor Requirements for HVAC Equipment," for chilled water pump motors. The pump motor rating shall not be exceeded for any operating condition with pumps operating individually or in parallel. All motors shall be inverter duty, suitable for variable speed operation. Variable speed drives will be specified for and provided separately.
- D. Refer to design criteria indicated on Drawings for chilled water pumps.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water distribution piping to verify actual location of connections before pump installation.

### 3.2 INSTALLATION

- A. General: Pumps shall be installed by the Contractor at locations indicated, in accordance with the manufacturer's written instructions and with access for periodic maintenance, including removing motors, impellers, coupling, and accessories.
- B. Rigging for off loading of the pumps shall be in accordance with the pump manufacturer instructions and shall be performed by experienced rigging personnel provided by the contractor. Installation of all of the pumps shall occur concurrently to minimize the disruption of the University's operations.
- C. Piping: Suction and discharge piping shall be installed as indicated on the contract drawings. If piping cannot be installed as indicated advise the University/engineer before commencing any work. Support pipe such that weight of piping is not supported by pump. If suction line is larger than the pump suction connection, eccentric reducers shall be used. The reducer shall be installed straight side up. If an elbow is required on the pump suction, a long radius elbow shall be used with required straight pipe diameters.
- D. Alignment: All pumps and drivers shall be aligned, by a millwright using a laser, (angular and parallel) in accordance with the manufacturer's recommendations after the complete unit has

been leveled, the grout has set and foundation bolts have been tightened. The alignment shall be rechecked by factory authorized personnel after the unit is piped and grouted.

1. Pump and driver shall be aligned to manufacturer's maximum permissible tolerances, but in no case shall angularity exceed 0.5 degree nor shall parallel misalignment exceed 0.002 inch.
  2. Pump alignment to be performed under the direction of manufacturer's representative.
- E. Leveling: The pump baseplate shall be placed and precision leveled to within the tolerances specified by the manufacturer. Leveling nuts shall be provided on the underside of the baseplate at the anchor bolts of which there shall be at least four (4). Once level, the baseplate shall be grouted into place. Check the coupling faces as well as the suction and discharge flanges of the pump for horizontal or vertical position by means of a level. The grout area between the top of the pad and the underside of the baseplate shall be at least 3/4" but not more than 1-1/2". The void area shall be completely filled with grout. Anchor bolts shall be tightened after grout work is completed.
1. Grout shall be ASTM C 1107, Grade B, non-shrink, non-metallic grout, complying with the grout manufacturer's instructions for surface preparation, forming, mixing, placing, curing, finishing, and cleaning the grouted areas.
  2. Raised face on steel Class 150 or Class 300 flanges for mating to cast iron pump flanges shall be ground flush.
  3. All pump and motor surfaces that have been damaged or scarred will be primed and painted with factory provided touch-up paint.
  4. Pump shall be dowelled in place with AISI 18-8 corrosion-resistant steel spiral wrapped pins before being subjected to pressure or piping reaction. After grouting and final alignment, and no sooner than after 40 hours of continuous operation, the driver shall be similarly dowelled in place. Taper pins are not acceptable.
- F. Prior to final pump acceptance, dial indicator gauges shall be used to demonstrate that pump casing is free of any piping loads.
- G. Lubricate pumps before start-up.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
1. Install common, valved pressure gage at suction and discharge of pumps. Install at pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 23 Section "Meters and Gages for HVAC" for pressure gages and gage connectors.
- B. Electrical wiring and connections are specified in Division 26 Sections.

### 3.4 COMMISSIONING

- A. Check suction piping connections for tightness.
- B. Clean strainers on suction piping.
- C. Final Checks before Starting: Perform the following preventive maintenance operations:
  - 1. Verify that pump is free to rotate by hand. Do not operate pump if it is bound or drags, until cause of trouble is determined and corrected.
  - 2. Verify that pump controls are correct for required application.
- D. Starting procedure for pumps is as follows:
  - 1. Prime pump by opening suction valves, drains and vent then closing drains & vent, and prepare pump for operation.
  - 2. Open circulating line valve if pump should not be operated against dead shutoff.
  - 3. Check general mechanical operation of pump and motor.
  - 4. Close circulating line valve once there is sufficient flow through pump to prevent overheating.

### 3.5 MANUFACTURER'S REPRESENTATIVE FIELD INSPECTION

- A. The Pump Manufacturer shall provide the services of a factory trained Technician (see part 1.7-B) for at least one (1) 8-hour day, dedicated to inspect the pump installations and align the pumps to within the specified tolerances or better, if the manufacturer requires a more stringent tolerance. Align the pump to within the required tolerance using methods outlined in the Hydraulic Institute "Instructions for Installation, Operation and Maintenance" or the manufacturer's printed instructions. Perform pump alignment after supported and after grout has cured. The factory trained Technician shall inspect the pump installations and provide a field report indicating any required repairs, modifications or adjustments and provide certification that the pumps have been installed properly and are operating properly contingent on the repairs, if any.
- B. Start-Up: The factory trained Technician shall comply with manufacturer's written instructions for start-up of operation, but not less than the following:
  - 1. Verify lubrication of rotating parts; lubricate as needed.
  - 2. Verify pump rotation direction.
  - 3. Verify that motor amperage is in accordance with manufacturer's data.
  - 4. Balance water flow, as applicable.
  - 5. Verify operation of air vents, drains and gages.
- C. All required repairs, modifications and adjustments required for certification by the factory trained technician shall be completed by the Contractor. The pumps shall then be re-inspected by the factory trained technician until certificate of proper installation is issued. The Contractor shall complete the repairs, modifications, adjustments, and pay for the reinspection at no additional cost to the University.

### 3.6 FIELD TESTS

- A. Preparation for Tests: Before the scheduled commissioning tests, the Contractor shall have prepared the pumps in accordance with the recommendations of the manufacturer for start-up and operation.
- B. Field Testing: Field testing shall be performed by the testing agent of the Contractor to verify proper pump operation, alignment, performance, flow, head, motor current and voltage, at design point and no flow conditions, inspect for vibrations, measure noise level and check for leaks.
  - 1. Noise and vibration testing shall be performed in accordance with ASHRAE applications handbook chapter 34 "Testing Adjusting and Balancing" and Chapter 43 "Sound and Vibration Control", ANSI S12.34 and IEEE-85. Pump operating sound levels shall not exceed 91 dBA at a distance of 5 feet and an elevation of 5 feet above the pump base.
  - 2. Pump Vibration Testing: A calibrated, certified vibrometer shall be provided for pump-vibration checking. The instrument shall be readable to 0.0001 inch deflection. Testing shall be performed by an experienced operator with vibration equipment training and certification. The manufacturer's factory trained technician shall provide a tabulation of readings and points read, together with instrument data. Vibrometer shall remain the property of the factory trained technician. Baseline testing to establish acceptance criteria based on manufacturer recommendations shall be required.
- C. Testing Agent: Testing shall be performed by a testing agency or personnel employed directly by the Contractor, who are qualified to perform the test.
- D. Test Conditions: The operating conditions of the pumps and the constancy of test conditions indicated in the Hydraulic Institute Standards will be maintained during the tests.
  - 1. Performance testing shall consist of a minimum of five test points over the pump flow range from shutoff to 125 percent of design and include the pump design point and minimum flow point. Motor current shall be measured and recorded. The test results shall be submitted in a certified report.
- E. Witness: Tests shall be witnessed by the University's commissioning team and representatives of the University and Engineer. The Pump Manufacturer may witness the test at its option and own expense.

### 3.7 IDENTIFICATION

- A. Nameplates shall be attached at a visible and non-removable part of the equipment using corrosion resistant material and containing the following information:
  - 1. Manufacturer Name and Address
  - 2. Equipment ID Number
  - 3. Serial Number
  - 4. Year Built
  - 5. Size, type and model number

6. Pump Speed
7. Head
8. Capacity
9. Impeller Diameter
10. Weight
11. Service

### 3.8 CLEAN-UP

- A. The Contractor shall remove all trash and debris from the pump and pad area, broom clean all surfaces and repair any damaged finishes on the pumps with touch-up paint provided by the Pump Manufacturer.

### 3.9 TRAINING

- A. Provide the services of the manufacturer's factory trained technician for one additional 8-hour day to instruct University personnel in the operation and maintenance of the pumps. Training shall be in the field and cover all pump and motor servicing including, but not limited to, seal, bearing, ring, motor, coupling, and impeller replacement. Schedule training two weeks in advance with the University.

END OF SECTION 232123

## SECTION 232213 - STEAM AND CONDENSATE HEATING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes pipe and fittings for HP steam and condensate piping:
- B. Related Requirements:
  - 1. Section 232216 "Steam and Condensate Piping Specialties" for strainers, , special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Other building services.
  - 2. Structural members.
- B. Welding certificates.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to the following:
  - 1. ASME Compliance: Comply with ASME B31.1, "Power Piping," for materials, products, and installation.
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

## 1.5 WELDING QUALITY ASSURANCE

- A. Welding Procedures: In the form of a submittal, the Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every welding procedure that he proposes. Procedures shall be developed for all metals included in the work. The procedures for making transition welds between different materials or between plates or pipes of different wall thickness shall be qualified. Qualification for each welding procedure shall conform to the requirements of ASME B31.1, and to this specification. The method for each system shall be fully described including the number of beads, the volts, the amperes, and the welding rod for various pipe thicknesses and materials. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be clearly referenced to the type of welding required for this project. These procedures shall be the same as those used for all pipe welder qualification tests, all shop welds, and all field welds. The Contractor shall provide Procedure Qualification Records for all proposed Welding Procedure Specifications (WPS).
- B. Welding Procedure Submittals: Submit the following:
1. Welding Procedure Specifications: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00006, QW-482 "Suggested Format for Welding Procedure Specification (WPS)".
  2. Procedure Qualification Records: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00007, QW-483 "Suggested Format for Procedure Qualification Record (PQR)".
- C. Welder Qualification:
1. WPQs: Provide welder qualifications for each welder for each weld type. It is highly recommended that the Contractor use ASME Form E00008, QW-484 "Suggested Format for Manufacturer's Record of Welder or Welding Operation Qualification Tests (WPQ)." The WPQs shall be performed under the witness of an independent agency. The witness shall be a representative of an independent testing agency, Authorized Inspector, or consultant, any of which must be approved by the National Certified Pipe Welding Bureau. The qualifying test segment must be a 2 inch nominal pipe size with wall thickness within range of the WPS. Tests position shall be "6G" per ASME Section IX.
  2. Evidence of Continuity: Welder qualifications must be current. If the qualification test is more than 6 months old, provide record of welding continuity for each welder. Record of welding continuity shall show that the welder in question has performed welding to the procedure in question without a 6 month continuous span of inactivity since the date that the welder qualification test was passed for the submitted welding procedure. Record of welding continuity shall include, at a minimum, the welder's employer name and address, the date the welder qualification test was passed, and the dates indicating welding continuity including welding procedure for each date.
- D. Weld Records:

1. For all welding within the scope of ASME B31.1, the Contractor shall submit for approval an administrative procedure for recording, locating, monitoring, and maintaining the quality of all welds to be performed on the project. This quality control document record shall include but not be limited to drawings and schedules identifying location of each weld by individual number, identification of welder who performed each weld by individual welder's name, stamp number, date, and WPS used.
2. After achieving qualification, but before being assigned work, each qualified person shall be assigned an identifying number by the Contractor that shall be used to identify all of his welds. A list of qualified persons with their respective numbers shall be submitted by the Contractor and shall be maintained accurately with deletions and additions reported promptly.
3. Upon completing a joint, the welder shall mark the pipe not more than 6 inches from the weld with the identifying number and the last two digits of the year in which the work was performed. Identification marks shall be made by using a rubber stamp or felt-tipped marker with permanent, weatherproof ink or other methods approved by the Architect/Engineer (A/E) that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at 3-foot intervals. Identification by die stamps or electric etchers will not be allowed. The markers are to be provided by the Contractor. Substituting a map of welds with welders' names shall not be acceptable.

E. Welder Pre-Qualification

1. All welders shall be pre-qualified for this project by having the first weld tested via radiographic (RT) method by the independent testing agency (ITA). Acceptance standards shall be in accordance with Paragraph 136.4.5 of ASME B31.1. The procedure shall be in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. The ITA shall submit the written procedure as described in Paragraph T-221 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. The ITA shall provide a report in accordance with Paragraph T-291 of Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. All persons performing and evaluating radiographic examinations shall be certified for NDT Level II RT as recognized by the ANST. A nationally certified Level III RT technician per ANST shall be on staff at the testing laboratory. A Corporate Level III RT without National Certification is not acceptable. These RT tests shall be used as the basis for the UT testing for the project. Welders shall do one weld and then have that weld tested and approved via RT before doing any more welding work. Maintain an active approved list with the University.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
1. 125S - HP Steam Piping: 150 psig saturated.
  2. 125C - Condensate Piping: 150 psig saturated.
  3. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.

4. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
5. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.
- B. Forged Steel Threaded and Socket Weld Fittings: ASME B16.11; Classes 150, and 300 as indicated in piping applications articles.
- C. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- D. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5 ANSI Classes 150 and 300, including bolts, nuts, and gaskets of the following end connections, and facings:
  1. End Connections: Butt welding.
  2. Facings: Raised face.
- E. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. 3/16" thick, 150# Flexitallic Type CG304 Stainless Steel or equal, in conformance with ASME B16.47 Annex B and ASME B16.20, for raised face.
  2. Valves equipped with integral gaskets will not require gaskets specified herein.
  3. Gaskets supplied by equipment vendors may be used if they are the equivalent to gaskets specified herein.
  4. Flanges connecting dissimilar metals shall be separated by an insulating kit including dielectric gasket.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

### PART 3 - EXECUTION

#### 3.1 HP STEAM PIPING APPLICATIONS

- A. HP Steam Piping, **NPS 2** and Smaller: Schedule 40, Type S, Grade B, steel pipe; ASME B16.11, Class 3000 forged carbon steel fittings; and ASTM Socket weld joints.
- B. HP Steam Piping, **NPS 2-1/2 through NPS 12**: Schedule 40, Type S or Electric Resistance Welded, Grade B, steel pipe; ASME B16.9 seamless ASTM A234 Grade WPB butt-weld fittings, ASME B16.6, Class 300 forged carbon steel, ASTM A105 RF weld-neck, fittings, flanges, and flange fittings; and welded and flanged joints.
- C. Condensate piping, NPS 2 and smaller, shall be the following:
  - 1. Schedule 80 Carbon Steel ASTM A53 Grade B Seamless pipe, ASME B16.11 3000# Forged Carbon Steel, ASTM A105, RF, Socket Weld or Threaded fittings; 3000# Forged Carbon Steel, socket weld or threaded, ASTM A105, steel/steel seats unions.
- D. Condensate piping, NPS 2-1/2 and larger, shall be the following:
  - 1. Schedule 80 Carbon Steel ASTM A53 Grade B Seamless pipe, ASME B16.9 Seamless ASTM A234 Grade WPB, Butt Weld fitting, same schedule as pipe; ASME B16.9 Seamless ASTM A234 Grade WPB, Butt Weld fittings, same schedule as pipe, ASME B16.5 Class 150 Forged Carbon Steel ASTM A105 RF, weld neck or slip-on flanges, same schedule as pipe.

#### 3.2 ANCILLARY PIPING APPLICATIONS

- A. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- B. Vacuum-Breaker Piping: Outlet, same as service where installed.
- C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

#### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 otherwise indicated.

- D. Install piping to permit valve servicing.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Install piping to allow application of insulation.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- J. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- K. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.
- L. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
- M. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
- N. Install branch connections to mains using tee fittings in main pipe, with the branch connected to top of main pipe.
- O. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated. Threaded fittings will only be used when connections to threaded vendor equipment.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- U. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.

### 3.4 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION

- A. Comply with requirements in Section 232216 "Steam and Condensate Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

### 3.5 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.
- B. Install the following pipe attachments:
  1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  4. Spring hangers to support vertical runs.
- C. Install hangers for steel steam supply piping with the following maximum spacing:
  1. NPS 3/4: Maximum span, 9 feet.
  2. NPS 1: Maximum span, 9 feet.
  3. NPS 1-1/2: Maximum span, 12 feet.
  4. NPS 2: Maximum span, 13 feet.
  5. NPS 2-1/2: Maximum span, 14 feet.
  6. NPS 3 and Larger: Maximum span, 15 feet.
- D. Install hangers for steel steam condensate piping with the following maximum spacing:
  1. NPS 3/4: Maximum span, 7 feet.
  2. NPS 1: Maximum span, 7 feet.
  3. NPS 1-1/2: Maximum span, 9 feet.
  4. NPS 2: Maximum span, 10 feet.
  5. NPS 2-1/2: Maximum span, 11 feet.
  6. NPS 3 and Larger: Maximum span, 12 feet
- E. Support vertical runs at each floor, and at 10-foot intervals between floors.

### 3.6 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. 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:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. 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.
- D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.7 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to **ASME B31.1, "Power Piping,"** 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 system with clean water. Clean strainers.
  - 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.
- B. Perform the following tests and inspections :
  - 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. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test.
  - 3. 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. System is acceptable if, after 2 hours, pressure loss is less than 2 psig.

- C. Prepare test and inspection reports.

END OF SECTION 232213

## SECTION 232216 - STEAM AND CONDENSATE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes the following piping specialties for HP steam and condensate piping:
  - 1. Strainers.
  - 2. Safety valves.
  - 3. Steam traps.
  - 4. Thermostatic air vents and vacuum breakers.
  - 5. Moisture Separators.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Strainer.
  - 2. Steam trap.
  - 3. Air vent and vacuum breaker
  - 4. Moisture Separator.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For valves, safety valves, steam traps, air vents, vacuum breakers, and meters to include in operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
  - 1. 125S - HP Steam Piping: 150 psig, saturated.
  - 2. Condensate Piping: 150 psig, saturated.
  - 3. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  - 4. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.

5. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

## 2.2 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."

## 2.3 STRAINERS

- A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Eaton.
  - c. Keckley.
  - d. Mueller Steam Specialty.
  - e. Spirax Sarco, Inc.
2. Provide Y-Pattern strainers full line size of connecting piping with ends matching piping system materials.
3. 2 inches and smaller: Carbon Steel body, screwed screen retainer with centered blow-down fitted with gate or ball valve, and stainless steel screen. Socket-welded ends.
4. 2-1/2 inches and larger: Carbon Steel body, bolted screen retainer with blow-down fitted with tapped blowoff plug, and stainless steel screens. Class 300 RF Flanged ends.
5. Strainer Screens: Stainless-steel, perforated (3/64") basket for HPS to turbine; 20 mesh in basket for inlet to traps.
6. SWP Rating: 250-psig working steam pressure.

## 2.4 SAFETY VALVES

- A. Provided by chiller manufacturer, selected to meet requirements of installed system.

## 2.5 STEAM TRAPS

- A. Thermodynamic Traps:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Spirax Sarco TD62 or comparable product by one of the following:
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. Dunham-Bush, Inc.
  - d. Hoffman Specialty
2. Body: Stainless steel with screw-in cap.
3. End Connections: Threaded.

4. Disc and Seat: Stainless steel.
5. Maximum Operating Pressure: 600 psig.

B. Float and Thermostatic Traps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Hoffman Specialty.
  - c. Spirax Sarco, Inc.
  - d. Sterling.
2. Body and Bolted Cap: ASTM A 126, cast iron.
3. End Connections: Threaded.
4. Float Mechanism: Replaceable, stainless steel.
5. Head and Seat: Hardened stainless steel.
6. Trap Type: Balanced pressure.
7. Thermostatic Bellows: Stainless steel or monel.
8. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
9. Maximum Operating Pressure: 150 psig.

2.6 STEAM MOISTURE SEPARATOR

- A. Basis of Design: Penn Separator Corporation model ISO 6-18, or equal.
- B. Description: Centrifugal entrainment separator. ASME Class 300 R.F. flanges. Carbon steel body. Constructed to ASME Boiler and Pressure Vessel Code Section VIII Div. 1 and stamped 300 psig working pressure.
- C. Conditions: Separator shall be rated at 25,000 lbs/hr of 125 psig saturated steam, pressure and temperature rated for ASME Class 300 steam system.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff duty valves at branch connections to steam supply mains, at steam supply connections to equipment, at the outlet of steam traps, and as indicated on drawings.
- B. Install safety valves as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.2 PIPING INSTALLATION

- A. Install piping to permit valve servicing.

- B. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install strainers on supply side of control valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger, or as indicated. Match size of strainer blowoff connection for strainers smaller than NPS 2, or as indicated.

### 3.3 STEAM-TRAP INSTALLATION

- A. Steam traps shall be provided at all low points in the steam piping system where condensate can collect, upstream of isolation valves and a maximum spacing of one per every 500 lineal feet of steam pipe.
- B. Install steam traps in accessible locations as close as possible to connected equipment.
- C. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

END OF SECTION 232216

## SECTION 232300 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping used for venting relief valves on the chiller.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: Show layout of refrigerant piping. Show interface and spatial relationships between piping and equipment.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

#### 1.7 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## PART 2 - PRODUCTS

### 2.1 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.
- C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Flexible Connectors:
  - 1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
  - 2. End Connections:
    - a. NPS 2 and Smaller: With threaded-end connections.
    - b. NPS 2-1/2 and Larger: With flanged-end connections.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-134A

- A. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated 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 Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- 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 adjacent to machines to allow service and maintenance.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Select system components with pressure rating equal to or greater than system operating pressure.
- H. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- I. Slope refrigerant piping as follows:
- J. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- L. Identify refrigerant piping according to Section 230553 "Identification for HVAC Piping and Equipment."

### 3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during welding, to prevent scale formation.
- D. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Isolate and fill vent pipe with 10' column (minimum) of water for 4 hours and inspect for leaks.

END OF SECTION 232300

## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Single-wall rectangular ducts and fittings.
- 2. Sheet metal materials.
- 3. Sealants and gaskets.
- 4. Hangers and supports.

- B. Related Sections:

- 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Sealants.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
- 2. Structural members to which duct will be attached.

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: **G60**.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: **3 inches**.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel.
  10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.
  4. Solids Content: Minimum 60 percent.
  5. Shore A Hardness: Minimum 60.
  6. Water resistant.
  7. Mold and mildew resistant.
  8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  9. VOC: Maximum 395 g/L.
  10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  11. Service: Indoor or outdoor.
  12. Substrate: Compatible with galvanized sheet steel.

## 2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.5 EXHAUST REGISTER

- A. One way deflection, with integral opposed blade damper.
- B. Titus 350 RL with standard white finish, or equal.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

- C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- D. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.6 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Exhaust Ducts:
  - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative **1-inch wg** .
    - b. Minimum SMACNA Seal Class: **C** if negative pressure,.

- C. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: **Galvanized steel.**
  
- D. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  
- E. Branch Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.

END OF SECTION 233113

## SECTION 236416 - CENTRIFUGAL WATER CHILLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Packaged, water-cooled, steam-turbine-driven centrifugal chillers.

- B. Related Sections:

- 1. Section 012500 "Substitution Procedures"
  - 2. Section 013300 "Submittal Procedures"
  - 3. Section 014000 "Quality Requirements"
  - 4. Section 014200 "References"
  - 5. Section 017300 "Execution"
  - 6. Section 230513 "Common Motor Requirements for HVAC Equipment"
  - 7. Section 230900. "Instrumentation and Control for HVAC"
  - 8. Section 283500 "Refrigerant Detection and Alarm" for refrigerant monitors, alarms, and ventilation equipment interlocks.

#### 1.3 DEFINITIONS

- A. PCS: Plant control system.
- B. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
- C. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and referenced to ARI standard rating conditions.
- D. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Condenser-Fluid Temperature Performance:

1. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of 55 deg F and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
  2. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of 55 deg F.
  3. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
- B. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
1. Performance at ARI standard conditions and at design condition indicated.
  2. Performance at ARI standard unloading conditions.
  3. Minimum evaporator flow rate.
  4. Refrigerant capacity of chiller.
  5. Oil capacity of chiller.
  6. Fluid capacity of evaporator, condenser, steam condenser.
  7. Characteristics of safety relief valves.
  8. Minimum entering condenser-fluid temperature.
  9. Performance at varying capacities with constant design condenser-fluid temperature. Repeat performance at varying capacities for different condenser-fluid temperatures from design to minimum in 5 deg F increments.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Wiring Diagrams: For power, signal, and control wiring.

### 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Structural supports.
  2. Piping roughing-in requirements.
  3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
  4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

- B. Source quality-control reports.
- C. Startup service reports.
- D. Warranty: Sample of special warranty.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. ARI Certification: Chiller shall meet the intent of the AHRI 550/590 certification program.
- B. AHRI 575 – Method of Measuring Machinery Sound Within an Equipment Space.
- C. ASHRAE Compliance:
  - 1. ASHRAE 15 for safety code for mechanical refrigeration.
  - 2. ASHRAE 34 for designation and safety classification of refrigerants.
  - 3. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- E. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, as applicable to chiller design. For chillers charged with R-134a refrigerant, include an ASME U-stamp and nameplate certifying compliance.
- F. Comply with NFPA 70.
- G. Comply with requirements of UL and UL Canada, and include label by a qualified testing agency showing compliance.
- H. HEI: Heat Exchanger Institute.
- I. NEMA SM 23, 1991: Steam turbines for mechanical drive service.
- J. OSHA: Comply with requirements of the Occupational Safety and Health Act.

#### 1.9 SHIPMENT

- A. Protect, pack and secure loose-shipped items and attach to chiller. Include detailed packing list of loose- shipped items, including illustrations and instructions for application.
- B. Cap and seal water nozzle openings to prevent moisture, foreign materials and other objects from entering heat exchangers.

- C. Provide reinforced shrink-wrap around entire exterior of the chiller components. The membrane shall cover the entire top, sides and ends to fully protect the chiller components during shipping and storage. Cover equipment, regardless of size or shape.
  - D. Ship units that are not shrink wrapped in an enclosed truck or shipping container. Tarping is not acceptable
  - E. Ship refrigerant separately. Mechanical contractor shall rig refrigerant into equipment room and place adjacent to the chiller. Manufacturer's technician shall charge unit at startup. Mechanical contractor shall remove and return empty refrigerant vessels.
  - F. Knocked down shipment and reassembly
    - 1. Chiller shall be fully assembled and tested before it is disassembled and prepared for shipment.
    - 2. All disassembly work is to be performed at the manufacturer's factory prior to shipment.
    - 3. No insulation shall be applied at the factory. Under a separate contract, field insulate chiller per manufacturer's insulation diagram and bill of materials.
    - 4. Ship chiller knocked-down into four major assemblies
      - a. Driveline (turbine and compressor)
      - b. Evaporator Shell
      - c. Condenser Shell
      - d. Steam surface condenser
      - e. Separate the evaporator and condenser shells. Close all refrigerant lines between the shells with steel cover plates. Charge with dry nitrogen at 2-3 psig.
  - G. Place compressor/turbine assembly on skids. Seal refrigerant suction and discharge openings with a steel plate. Charge with dry nitrogen at 2-3 psig.
  - H. Perform all rigging work with rigging contractor's labor. Supervise rigging activities with a technician who is factory trained and employed by the chiller manufacturer. The technician (as a minimum) shall be present when the shells are set in place and leveled, and when the driveline, starter, and suction elbow are lowered into position on the shells.
  - I. The manufacturer's technician shall complete re-assembly, including tightening of bolts to their recommended torque ratings, reconnection of intra-chiller electrical wiring, control wiring and refrigerant lines, etc.
  - J. The manufacturer's technician shall leak test the unit, checking thoroughly for leaks. Any leaks must be fixed before the technician charges machine with refrigerant and oil.
- 1.10 COORDINATION
- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
  - 1. Extended warranties include, but are not limited to, the following:
    - a. Complete compressor and steam turbine drive assembly including refrigerant and oil charge.
    - b. Water box corrosion-resistant finish.
  - 2. Warranty Period: Five years from date of factory startup.
  - 3. Warranty includes parts and labor to replace.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer shall have a minimum of 25 years of experience in designing, manufacturing, and servicing steam turbine driven chillers.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings manufactured by:
  - 1. Johnson Controls Inc. / York International Corporation.
  - 2. No known equal.
- C. Substitutions: If an alternate vendor is identified, Contractor shall submit information in accordance with the Division 1 section "Substitutions" and, if accepted, shall be responsible for all modifications to the work to accommodate the substitute product.

### 2.2 MANUFACTURED UNIT

- A. Description: Factory-assembled and -tested as possible chiller complete with centrifugal compressor, variable speed condensing turbine drive, compressor controller, lubrication system, evaporator, condenser, steam condenser, instrument control panel, controls, gages, interconnecting unit piping and wiring, and indicated accessories.
  - 1. Disassemble chiller into major assemblies, as required by the installation, after factory testing and before packaging for shipment.
- B. Chiller performance rating shall be in accordance with AHRI 550/590.
- C. IPLV/NPLV calculated in accordance with AHRI 550/590 equation.
- D. Efficiencies at 10% load increments at ECWTs: 85°F, 75°F, 65°F, 55°F.

### 2.3 COMPRESSOR-DRIVE ASSEMBLY

- A. Description: Single-stage, variable-displacement, centrifugal-type compressor driven by a condensing type steam turbine drive.
- B. Compressor:
  1. Fully accessible housing with vertical circular joints. The complete operating assembly shall have the capability to be removed from the compressor and scroll housing. Refrigerant inlet and outlet connections shall be flanged. Furnish sight glass for monitoring compressor rotation.
  2. Compressor casting shall be design for a minimum of 235 PSIG working pressure and hydrostatically pressure tested at a minimum of 352 PSIG.
  3. Each gear (low speed and high speed) shall have its own journal and thrust bearings for isolation from impeller and turbine forces.
  4. Impeller designed for balanced thrust and dynamically balanced and overspeed Single stage or multi stage, open-drive centrifugal type compressor with internal gears, driven by a variable-speed condensing turbine. Designed for the use of refrigerant R-134a.
  5. Vibration tested, free of operational vibration
  6. Insert-type journal bearings and thrust bearings fabricated of aluminum alloy, precision bored and axially grooved.
  7. Impeller: High-strength cast aluminum or cast-aluminum alloy on carbon- or alloy-steel shaft. Single or multi-stage, statically and dynamically balanced, tested to over operating speed.
- C. Drive: Gear-drive, open design using a steam turbine as the driver.
  1. Gear Drives: For chillers with gear drives, provide single-helical gear design continuously coated with oil while chiller is operating. Gears shall comply with American Gear Manufacturer Association standards.
  2. Seals: Seal drive assembly to prevent refrigerant leakage with double-bellows, double-seal cartridge type shaft seal.
- D. Turbine Drive:
  1. Condensing steam type: Dresser Rand model KDF, or equal.
  2. Steam supply, of steady-state conditions at the inlet of the governor valve shall define the criteria for turbine design and associated steam components supply, is defined as follows.
    - a. Absolute Maximum Conditions, a non operating point set by safety devices in place in the steam supply to prevent, even briefly exceeding, the conditions of 186 psig, 382 deg. F.
    - b. Maximum Continuous Operating Conditions of 140 psig, 361 deg. F.
    - c. Rated Inlet Steam Conditions at Chiller Design Conditions of 125 psig, 353 deg. F.
    - d. Minimum Steam Conditions allowed for 100% of chiller capacity of 115 psig, 347 deg. F.
  3. The provision of the new steam turbine shall be complete with, but not limited to, the following:
    - a. The steam turbine shall be of a high efficiency multistage condensing design operating at a nominal 4500 rpm design maximum speed. Capable of developing

105% of required compressor full load horsepower at the specified steam conditions. The turbine shaft shall be flexible type. The turbine shall be suitable for both dry, saturated steam with zero degrees superheat and superheated steam of 430 degrees at the inlet. Constructed per NEMA SM23-1991 Standard.

- b. The turbine shall be packaged on a driveline base, completely factory piped. The driveline base shall have a mating flange on shaft end of the package that will bolt directly to the compressor flange face providing a rigid interface between turbine package and compressor. Complete turbine/compressor driveline shall be factory aligned prior to shipment.
- c. Turbine drive shaft shall be directly connected to the compressor shaft with a flexible disc coupling, in accordance with NEMA Turbine Standard SM-23-1991 and factory tested in accordance with these standards. No external gearbox allowed. Coupling shall have all metal construction with no wearing parts to assure long life, and no lubrication requirements to provide low maintenance.
- d. Resonant frequencies of turbine shaft, blades and other parts shall not occur within the operating speed range of the turbine.
- e. Bearings:
  - 1) Main journal bearings shall be horizontally split sleeve type, steel-backed, Babbitt-lined. Suitable for removal without disturbing turbine casing, glands or rotor, and lubrication system.
  - 2) Seal to prevent leakage or seepage of oil and gland leakage.
- f. The turbine speed control shall be achieved by a governor valve that is integrated with the chiller controls. The valve shall control flow throughout startup and the entire operating range of the turbine.
- g. Electronic tachometer, integral part of the chiller control panel.
- h. The system shall employ an overspeed governor designed to close an independent high performance butterfly trip valve with a pneumatic actuator when the turbine speed exceeds 110 percent of the maximum continuous operating speed of the turbine. Activation of the independent trip valve shall cause the governor valve to also close. A micro switch shall be furnished on the trip linkage for the customer's use.
- i. A solenoid operated trip mechanism for automatic turbine shutdown operation in conjunction with cutout switches associated with compressor shall be provided.
- j. A stainless steel, inlet steam strainer with proper size and mesh to minimize the pressure drop shall be supplied. Strainer shall be removable without breaking the steam piping connections.
- k. A solenoid operated vacuum breaker shall be supplied to insure quick shutdown of the turbine in the event of a trip.
- l. Stainless steel nozzles shall be supplied throughout the turbine.
- m. Two valves shall be supplied to control nozzles, one for part load reduced steam flow, and one to add additional steam flow when needed during reduced steam pressure periods.
- n. A fiberglass blanket, canvas enclosed, surrounding the steam chest and barrel of the turbine shall be provided for acoustical reduction and thermal insulation providing operator protection.
- o. Steam chest shall be steel. The casting shall be cast iron, horizontally split designed to allow longitudinal thermal expansion without affecting alignment or efficiency of the turbine. Complete with lifting lugs, the casting shall facilitate removal and inspection of rotor without breaking high pressure steam joint.

- p. A pressure powered pump with a steel condensate drain tank shall be furnished to remove condensate from the turbine casing. The condensate shall be automatically drained into the tank, and when activated by a ball float, remove condensate from the tank by means of steam pressure. The tank shall be provided with a full height gage glass. The pump assembly shall be selected and provided by the manufacturer, to meet the demands of the system.
  - q. The inlet flange shall be dimensional, faced and drilled to conform to latest ASA standard. The inlet shall be a Class 300 ANSI R.F. flange. The exhaust shall face upward with a Class 125 F.F. flange.
  - r. The rotor shaft and wheels shall be alloy steel with the wheels shrunk and keyed to the shaft. The turbine blades shall be of 403 grade stainless steel and the shaft shall be ground throughout with stainless steel sprayed in the carbon ring end gland contact area.
  - s. Carbon ring end gland and diaphragm seals shall be furnished. Turbine end gland carbon ring seals (minimum of five seals per gland) shall be separated by partitions of stainless steel. The end gland seals are to be arranged for the admission of sealing steam. Pressure reducing valves shall be provided to regulate the steam pressure from steam inlet pressure to the 1-3 PSIG needed for the gland seal.
  - t. Interstage seals.
  - u. Casing seals.
  - v. Lubricants as required.
  - w. Shop drawing and auxiliary data.
  - x. Turbine start up and test by a technician trained by the turbine manufacturer.
  - y. Final painting with chiller manufactures' standard color.
  - z. Operating instruction manuals.
  - aa. Gaugeboard consisting of a tachometer and pressure gauges for steam inlet, nozzle ring, and exhaust.
4. Expansion joint: Bellows type tied expansion joint suitable for connection between turbine exhaust and steam condenser inlet, designed in accordance with the standards of the expansion joint manufactures association.
- a. Bellows and flow liner of stainless steel, rated for 1,000,000 cycles.
  - b. Operating conditions of full vacuum to 15 psig, 30 degrees F to 250 degrees F.
5. Steam exhaust connection, expansion joint to steam condenser, shall be sized at 450 ft/sec maximum steam velocity. Pipe to be standard weight and maximum 40 ft long including fittings. Per NEMA 23-1991.
- E. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.
- 1. Overspeed Test: 25 percent above design operating speed.
- F. Service: Easily accessible for inspection and service.
- 1. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
  - 2. Provide lifting lugs or eyebolts attached to casing.
- G. Steam Turbine Oil Lubrication System:

1. External pressure lubrication system: integral to the driveline base and completely factory piped, including the following:
  - a. Turbine shaft driven main oil pump.
  - b. Thrust bearing shall be double acting, kingsbury type.
  - c. Motor driven auxiliary oil pump.
  - d. Water cooled shell and tube oil cooler.
    - 1) Oil filter, full flow -or- dual 25 micron filters and separate oil reservoir with level gauge.
    - 2) Oil temperature control via three way temperature control valve.
    - 3) Lube cooling water circuit of combined compressor and turbine systems, feed from secondary side of shell and tube heat exchanger using condenser water on the primary side.
2. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, coastdown, and standby conditions including power failure.

#### 2.4 CAPACITY CONTROL

- A. Constant leaving chilled water maintained in off design conditions from 100% to 15% load by first decreasing speed, then closing pre-rotation vanes.
- B. Maintain stable operation that is free of surge, cavitation, and vibration throughout range of operation. Configure to achieve most energy-efficient operation possible.
- C. Speed maintained by a pneumatically operated governor valve on the steam supply to the turbine, controlled by the chiller control system.
- D. Steam Throttle Valve:
  1. Rotary Control Valve: Fisher Vee-Ball model V200 SEP B, or equal.
    - a. Description:
      - 1) Body Material: Steel
      - 2) Ends: Class 300 Raised Face Flange
      - 3) Seats: Comp
      - 4) Shaft: Stainless Steel, 17-4PH
      - 5) Ball: V-Notch, Stainless Steel, PL
  2. Actuator
    - a. Fisher Type 1052, or equal.
- E. Pre-rotation guide vanes positioned by solid rod linkage and connected to an easily serviceable, externally mounted electric actuator.
- F. Mechanical linkage system that continuously monitors compressor-discharge gas characteristics and optimizes diffuser spacing to minimize impeller gas-flow disruptions.

- G. The unit shall be capable of continuous, reliable operation with low ECWT and achieve design capacity.

## 2.5 COMPRESSOR LUBRICATION SYSTEM

- A. Force-feed oil to all bearings, gears and rotating surfaces by a variable speed which operates prior start-up, continuously during operation and coast down.
- B. Gravity fed oil reservoir internal to the compressor provides lubrication during a power failure event.
- C. Oil reservoir: designed in accordance with ASME; consisting of an oil pump and oil heater
- D. Oil pump: positive-displacement type, submerged in oil reservoir.
- E. Oil filter: dual filter, externally mounted, ½ micron, replaceable cartridge, with service valves
- F. Oil return system: oil eductor to recover and return oil in the evaporator to the main oil sump.
- G. Oil cooler: water cooled, factory mounted, factory piped and pressure tested, supplied with inlet strainer and solenoid valve for automated start/stop of cooling water flow.
- H. Oil heater: immersion type, thermostatically controlled
- I. Oil temperature control by a three way temperature control valve.
- J. Pump operation: automatically operate oil pump for 30 seconds (minimum) prior to rotation. Prevent startup until operating oil pressure is established via an interlock with the control panel. Maintain pressure during compressor coast down, and for 30 seconds (minimum) after rotation has stopped.
- K. Means of lubrication after power failure during coast down of driveline. A gravity-fed oil reservoir or a UPS/battery backup to oil pump or a shaft-driven oil pump are acceptable.

## 2.6 REFRIGERATION

- A. Refrigerant:
  - 1. Type: R-134a; ASHRAE 34, Class A1.
  - 2. Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
- B. Refrigerant Flow Control:
  - 1. Variable refrigerant orifice.
  - 2. Refrigerant level sensing: monitor refrigerant level in the condenser; report refrigerant level back to unit control panel and control chiller accordingly.
  - 3. Refrigerant level control: adjust valve position via control panel to optimize refrigerant level.

- C. Pressure Relief Device:
  - 1. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. For Chillers Using R-134a: ASME-rated, spring-loaded, pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger. Condenser shall have dual valves with one being redundant and configured to allow either valve to be replaced without loss of refrigerant.
- D. Refrigerant Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to an existing remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.
- E. Refrigerant Isolation for Chillers Using R-134a: Factory install positive shutoff, manual isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell.

## 2.7 EVAPORATOR

- A. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.
- B. Designed for a minimum of 180 psig on refrigerant side.
- C. Water side working pressure: 150 psig.
- D. Construct in accordance with ANSI/ASHRAE-15-1994 Safety Code for Mechanical Refrigeration and ASME Pressure Vessels Code and shall bare the ASME stamped nameplate.
- E. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
- F. Designed to prevent liquid refrigerant carryover from entering compressor.
- G. Provide evaporator with sight glass or other form of positive visual verification of liquid-refrigerant level, located such that the proper refrigerant charge is near the center of the glass when the machine is off.
- H. Tubes:
  - 1. Individually cleanable and replaceable from either end and without damage to tube sheets and other tubes.
  - 2. Mechanically expanded into end sheets and supported at intermediate tube sheets.
  - 3. Material: Copper alloy.
  - 4. Nominal OD: 3/4 inch.
  - 5. Minimum Wall Thickness: 0.028" within enhanced lengths, 0.035" at the plain ends contacting the intermediate tube supports and end sheets.
  - 6. External Finish: Enhanced.
  - 7. Internal Finish: Rifled.

8. High efficiency type.
  - I. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell. 1” thick minimum.
  - J. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals no more than 4 feet apart to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear. 3/8” thick minimum.
  - K. Suction Baffle / Mist Eliminator: Installed along the entire length of the evaporator.
  - L. Water Box:
    1. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
    2. Designed for 150 psig design working pressure, and tested at 225 psig.
    3. Hinged marine water-box covers – both ends.
    4. Nozzle Pipe Connections: Welded, ASME B16.5, raised-face flange.
    5. Thermistor or RTD temperature sensor factory installed in each nozzle.
    6. Fit each water box with 3/4-inch drain connection at low point and vent connection at high point, each with threaded plug.
  - M. Oil Return: Oil educator to recover and return oil from the evaporator to the main oil sump.

## 2.8 CONDENSER

- A. Description: Shell-and-tube design with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.
- B. Designed for a minimum of 235 psig on refrigerant side.
- C. Water side working pressure: 150 psig.
- D. Construct in accordance with ANSI/ASHRAE-15-1994 Safety Code for Mechanical Refrigeration and ASME Pressure Vessels Code and shall bare the ASME stamped nameplate.
- E. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.
- F. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.
- G. Provide condenser with sight glass or other form of positive visual verification of refrigerant charge and condition.
- H. Tubes:
  1. Individually cleanable and replaceable from either end and without damage to tube sheets and other tubes.
  2. Mechanically expanded into end sheets and supported at intermediate tube sheets.

3. Material: Copper alloy.
  4. Nominal OD: 3/4 inch.
  5. Minimum Wall Thickness: 0.028" within enhanced lengths, 0.035" at the plain ends contacting the intermediate tube supports and end sheets.
  6. External Finish: Enhanced.
  7. Internal Finish: Rifled.
  8. High efficiency type.
- I. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes with positive seal between fluid in tubes and refrigerant in shell. 1" thick minimum.
- J. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals no more than 4 feet apart to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear. 3/8" thick minimum.
- K. Water Box:
1. Carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
  2. Designed for 150 psig design working pressure, and tested at 225 psig.
  3. Hinged marine water-box covers – both ends.
  4. Nozzle Pipe Connections: Welded, ASME B16.5, raised-face flange.
  5. Thermistor or RTD temperature sensor factory installed in each nozzle.
  6. Fit each water box with 3/4-inch drain connection at low point and vent connection at high point, each with threaded plug.
- L. Additional Corrosion Protection:
1. Electrolytic corrosion-inhibitor anode.
  2. Coat wetted surfaces, including water boxes and end tube sheets with a corrosion-resistant finish equal to Belzona Supermetal Glide, Enecon CeramAlloy (trowel), or Chemclad SC (brush), or equal.
    - a. Coating shall be applied at the factory.
    - b. Provide formal report of the treatment, indicating thickness applied and surfaces treated, and any quality control process checks.
- 2.9 STEAM CONDENSER
- A. A steam condenser shall be provided to condense exhaust steam at vacuum pressures to maintain efficient turbine operation. The steam condenser water circuit shall be piped in series with the refrigerant condenser. The construction of the steam condenser shall allow mounting on top the chiller, shall be of the shell-and-tube design with water enclosed in tubes and steam enclosed in the shell, complete with but not limited to the following:
1. The steam condenser shall be furnished fully packaged. The package shall include dual hotwell pumps, dual liquid ring vacuum pumps for air removal, atmospheric relief valve and a level control system. Each pump capable of 100% design capacity. Hotwell pumps shall be capable of providing 25 psi at the field connection for condensate return

2. The package shall be factory piped, wired and mounted on a common structural steel frame suitable for installation on the refrigerant condenser.
  
- B. Steam condenser construction shall be of the shell and tube type of welded steel construction with ¾"-or- 1" OD prime surface copper tubes, roller-expanded into tube sheets. Maximum tube velocity of 10 feet per second. Water side shall be suitable for a maximum working pressure of 150 psig. Steam side shall be designed for 15 psig and 30" Hg vacuum.
- C. Shell construction shall be of welded carbon steel plate. Intermediate tube sheets no greater than 4'-0" on center to support tubes and prevent vibration.
- D. Water boxes shall be welded steel with hinged removable covers on both ends.
- E. Condensate level shall be controlled by a level control system with two (2) pneumatic control valves - one for re-circulation and the other for removal of condensate.
- F. Liquid ring vacuum pumps shall be capable of drawing the condenser down to operating pressure in approximately 15 minutes. Hotwell pumps shall be single-stage, end suction suitable for hotwell service.
- G. Atmospheric relief valve shall be a water seal type with external handwheel, sized in accordance with the Heat Exchange Institute Standards (HEI) for protection of the steam turbine exhaust, steam trunk and steam condenser.
- H. Manufacturer shall provide all necessary control and power wiring between the steam condenser junction box, and chiller junction box.
- I. All key control and monitoring parameters shall be integral to the chiller control panel. In addition, auxiliary pressure gauges shall be located at the condenser steam inlet and condensate pump discharge piping, and temperature gauges shall be located at the steam inlet, cooling water inlet and outlet, and the hotwell.
- J. To facilitate rigging, the condenser shall be separable from the skid by unbolting. Piping shall be outfitted with unions at reasonable breakpoints. Both condenser and skid shall be outfitted with lifting lugs for both vertical and horizontal lifting.
- K. Additional Corrosion Protection:
  1. Electrolytic corrosion-inhibitor anode.
  2. Coat wetted surfaces, including water boxes and end tube sheets with a corrosion-resistant finish equal to Belzona Supermetal Glide, Enecon CeramAlloy (trowel), or Chemclad SC (brush), or equal.
    - a. Coating shall be applied at the factory.
    - b. Provide formal report of the treatment, indicating thickness applied and surfaces treated, and any quality control process checks.

## 2.10 INSULATION

- A. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Thickness: Refer to 230716.
- B. Field-applied insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, and auxiliary piping.
  - 1. Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
  - 2. Seal seams and joints to provide a vapor barrier.

## 2.11 MANUFACTURER SUPPLIED EQUIPMENT, FIELD INSTALLED BY CONTRACTOR

- A. Components shipped loose with chiller equipment:
  - 1. Condenser to Steam Condenser Connection: Two pipe sections for field fitting between condensers. Alignment of these connections must be completed prior to securing the steam condenser in place.
  - 2. Pressure Powered Pump - A steam powered condensate pump for removal of condensate from the turbine casing. The self contained unit shall use steam pressure to transfer condensate from a negative pressure to a positive pressure discharge.
  - 3. Exhaust bellows: Supplied to match the diameter of the turbine exhaust flange, the tied expansion joint shall have the tie connector nuts field tack welded.
  - 4. Exhaust Trunk Piping: Supplied by the chiller manufacture, prefabricated in two piping assemblies, to be field fitted between the turbine exhaust bellows and inlet flange of the steam condenser.
  - 5. Steam Throttle Valve: Shall be installed and supported as close as practical to the turbine inlet flange. Short spool piece shall be supplied by manufacturer.
  - 6. Gaugeboard - The gaugeboard shall be equipped with all necessary gauges required for the turbine and shall include the tachometer indicator.
- B. Installer procedures and steam components, including but not limited to the following:
  - 1. Steam Supply Connection: Install per design supplied by the customers' representative, to follow the guidelines of NEMA SM23-1991 for specific site conditions.
  - 2. Steam Pipe Alignment & Strain Test: Follow manufactures' recommended installation procedure for pipe strain testing.
  - 3. Steam Piping Blow-Down: Follow manufacturers' recommended installation procedure for cleaning of supply steam piping. Retain targets for startup inspection.
  - 4. Condensate pipe from the steam condenser shall be capable of returning condensate at the rate of the steam flow, either with the pressure supplied at the steam condenser or with an additional inline pump.
  - 5. Additional Piping Connections: Connections as identified by the chiller manufacturer for city water, instrument air, drains and vents.

## 2.12 AUXILIARY ELECTRIC MOTORS

1. Refer to specification section 230513 “Common Motor Requirements for HVAC Equipment.”

## 2.13 ELECTRICAL

- A. Factory installed and wired, and functionally tested at factory before shipment.
- B. Single-point, field-power connection to fused disconnect switch or molded case circuit breaker. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 25,000 A.
  1. Branch power circuit to each motor, electric heater, dedicated electrical load, and controls with fused disconnect switch.
    - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
  2. NEMA ICS 2-rated motor controller for auxiliary motors, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller for each variable-speed motor furnished.
  3. Control-circuit transformer with primary and secondary side fuses.
- C. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.

## 2.14 CONTROLS

- A. Controller: Provide standalone, Allen-Bradley PLC-based, CompactLogix control system. Factory-mounted, wired and tested PLC-based Control Center shall be based on control systems for R134a centrifugal chillers.
- B. Memory: All memory shall be stored in nonvolatile memory (Flash Minicard) to eliminate chiller failure due to AC power failure/battery discharge. Programmed set points shall be retained in lithium battery-backed RTC memory for 11 years minimum.
- C. Enclosure: Unit mounted, NEMA 250, Type 12, hinged or lockable; factory wired with a single-point, field-power connection and a separate control circuit.
- D. Operator Interface: Color graphic display with dynamic update of information and with touch-sensitive display located on front of control enclosure. The panel shall be configured with a 10.4-in. diagonal color Liquid Crystal Display (LCD) surrounded by “soft” keys, which are redefined with one keystroke based on the screen displayed at that time.
- E. The LCD display shall provide a graphical and animated display of the chiller, chiller sub-systems and system parameters, allowing the presentation of several operating parameters at once. A Status Bar shall be displayed at all times on all screens containing the System - Status Line and Details Line, the Control Source, Access Level, Time and Date.

- F. When the power is applied to the chiller, the HOME screen shall be displayed. The HOME screen shall display a visual representation of the chiller and a collection of data detailing important operations and parameters. The primary values that need to be monitored and controlled shall be shown on this screen. During turbine pre-warming, slow roll, startup, operation and coast-down, the system status shall indicate vital information available at any time. In either English or SI units selectable through the interface, display the following information:
1. Date and time.
  2. Operating or alarm status.
  3. Fault history with not less than last 10 faults displayed.
  4. Set points of controllable parameters.
  5. Trend data.
  6. Operating hours.
  7. Number of chiller starts.
  8. Entering- and leaving-fluid temperatures of evaporator, condenser and steam condenser.
  9. Difference in fluid temperatures of evaporator and condenser.
  10. Proof of fluid flow of evaporator and condenser.
  11. Fluid pressure drop of evaporator and condenser.
  12. Refrigerant pressures in evaporator and condenser.
  13. Refrigerant saturation temperature in evaporator and condenser shell.
  14. Compressor refrigerant suction and discharge temperature.
  15. Oil temperature.
  16. Oil discharge pressure.
  17. Turbine speed.
- G. The panel shall be fused through a 2 KVA transformer to provide individual over-current protected power for all controls. Numbered terminal strips for wiring such as Remote Start / Stop, Chilled Water Pump and Local or Remote Cycling devices shall be provided. The Panel must also provide field interlocks that indicate the chiller status. These contacts shall include a Remote Mode Ready-to-Start, a Controlled Shutdown, a Safety Shutdown and a chiller Run contact. System pressures shall be monitored with transmitters (4-20 mA) and transducers (0-5 VDC). System temperatures shall be monitored using thermistors and RTD's.
- H. Control Functions:
1. Manual or automatic startup and shutdown time schedule.
  2. Entering and leaving chilled-water temperatures and control set points. Evaporator fluid temperature shall be reset based signal from PCS via Ethernet connection to Control Panel.
  3. Condenser-fluid temperatures.
  4. External chiller emergency stop.
  5. Every programmable point shall have a pop-up screen with the allowable ranges, so that the chiller cannot be programmed to operate outside of its design limits.
  6. The capacity control logic shall provide stable operation at maximum efficiency at off design conditions by modulating the turbine speed, compressor pre-rotation vanes and hot gas by-pass valve..
- I. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

1. Low evaporator fluid temperature.
  2. Low/High oil differential pressure.
  3. High or low oil pressure.
  4. High oil temperature.
  5. High compressor-discharge temperature.
  6. Loss of condenser-fluid flow.
  7. Loss of evaporator fluid flow.
  8. Turbine overspeed.
  9. Processor communication loss.
  10. Compressor thrust bearing proximity probe.
  11. Turbine excessive vibration.
- J. Automated Startup: An automated start option shall allow the start of the chiller with one button starting locally at the chiller. Automated starting shall include turbine vibration monitoring, automation of turbine part-load and overload valves, and a pressure powered pump to remove steam condensate from the turbine casing.
- K. Trending: Capability to trend analog data of up to 6 parameters simultaneously over an adjustable period and frequency of polling.
- L. Security Access: Provide electronic security access to controls through identification and password at all levels, with at least three levels of access: view only; view and operate; and view, operate, and service.
- M. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.
- N. Communication Port: RS-485 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.
- O. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms over a copper Ethernet connection.
1. Industry-accepted, open-protocol, Ethernet communication interface with the PCS shall enable the PCS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the PCS.
- 2.15 EXISTING CHILLER CONTROL PANEL RETROFIT
- A. Provide new control panel, controller and associated control equipment to match installation of Chiller 8 on existing Chiller-5, Chiller-6, and Chiller-7.
1. Controller: Provide standalone, Allen-Bradley PLC-based, CompactLogix control system. Field-mounted, factory-wired and tested PLC-based Control Center shall be based on control systems for R134a centrifugal chillers.
  2. Comply with all requirements identified in paragraph 2.14 "CONTROLS" subparagraphs B through O, this section.
- B. Phasing of Control Panel Retrofit Work

1. Chiller-8 shall be fully tested and operational prior to taking out of service and modifying existing Chiller-5, Chiller-6 or Chiller-7.
2. Existing chiller modifications shall occur one unit at a time.
3. A maximum of one chiller may be out of service at any given time, until completion of work.

2.16 FINISH

- A. Paint chiller, using manufacturer's standard procedures, except comply with the following minimum requirements:
  - 1. Provide two coats of primer with a total dry film thickness of at least 2 mils.
  - 2. Paint installed insulation to match adjacent uninsulated surfaces.
  - 3. Color of finish coat to be manufacturer's standard.
- B. Provide Owner with quart container of paint used in application of topcoat to use in touchup applications after Project Closeout.

2.17 ACCESSORIES

- A. Flow Switches:
  - 1. Chiller manufacturer shall furnish a thermistor (hot wire anemometer) switch for each evaporator and condenser factory installed and wired.
- B. Vibration Isolation:
  - 1. Chiller manufacturer shall furnish manufacturer's standard vibration isolation pads for each chiller.

2.18 CAPACITIES AND CHARACTERISTICS

- A. Capacity: 2100 Tons.
- B. Full-Load Efficiency:
  - 1. COP: 1.12
- C. Part-Load Efficiency:
  - 1. NPLV: 1.74 (COP).
- D. Evaporator: See schedule on drawings.
- E. Condenser: See schedule on drawings.
- F. Steam Condenser: See schedule on drawings.
- G. Compressor:
  - 1. Number of Compressors: One.
- H. Chiller Control Electrical Requirements:
  - 1. Power Connections: Integral.

2. Power Input: Vendor provide.
3. Volts: 120-V ac.
4. Phase: Three.
5. Hertz: 60.

I. Chiller Electrical Requirements:

1. Volts: 480-V ac.
2. Phase: Three.
3. Hertz: 60.

2.19 SOURCE QUALITY CONTROL: TESTS AND INSPECTIONS

A. Heat Exchangers, evaporator and refrigerant condenser (performed by manufacturer):

1. Design and test in full conformance to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
2. Hydrostatically test evaporator and condenser refrigerant side at 1.3 times design working pressure AFTER tubing using LIQUID REFRIGERANT.
3. Alternately to item '2.' above, test at 1.3 times design working pressure BEFORE tubing, using WATER; then test at 1.1 times design working pressure AFTER tubing, using AIR.

B. Compressor Components (performed by manufacturer):

1. Leak tested at design working pressure using air under water.
2. Hydrostatic strength test at 1.5 times design working pressure.
3. To ensure hydrostatic strength, test at 3 times design working pressure every year on the compressor castings.
4. Statically and dynamically balance each impeller.
5. Overspeed test each impeller at 120% of its maximum design RPM.
6. A pressurized test of the compressor shall be performed. A leak rate greater than 1 ounce of refrigerant in 10 years is not acceptable for an individual leak.

C. Chiller leak integrity testing: Pressurize entire system to design working pressure. Leak test using soap and water. Repair any leaks and repeat test until leak tight

D. Vacuum hold testing: Evacuate system to 500 microns and hold for one hour. Ensure that pressure does not rise more than 150 microns during the hour. Repair and repeat until passes.

E. Turbine (performed by manufacturer):

1. Casing Hydrostatic Test:

- a. Test steam casting base per ASTM A216 WCB.
- b. Test steam casing cover and exhaust casing per ASTM A278CI.40.

2. Rotor Dynamic Balance and Clearance:

- a. Assembled with a balanced rotor, and operating at maximum continuous speed or any other speed within the specified operating range the peak-to-peak amplitude of

unfiltered vibration in any plane, measured on the adjacent shaft relative to the radial bearing must not exceed 2.0 mils.

3. Mechanical Run Test:
    - a. Prior to run test, all oil pressures and temperatures must be within the range of operating values.
    - b. Oil system shall be cleaned prior to run test with oil circulated through a 100 plain mesh weave screen. Particles may not exceed 0.01 inch to be considered a clean lubrication system. If the oil system is dismantled prior to the run test, an additional oil circulation test must be passed.
    - c. All speed outputs, pressure and temperature switches, RTD's, thermocouples, actuator travel must be verified for correct values and adjustments during the run test.
    - d. Radial vibration recorded by either non-contacting vibration probes or portable vibration meter. Peak vibration must not exceed 0.15 inches per second (unfiltered) and 0.10 inches per second (filtered).
    - e. Overspeed trip shall be checked and adjusted until three consecutive trip values within +/-1 percentage of the normal trip setting are attained.
    - f. Any critical speed below maximum continuous speed shall be determined and recorded on the Mechanical Run Test Report.
  4. Bearing Disassembly Inspection:
    - a. Bearings shall be inspected for damage as burns, nicks, excessive wear, cuts and grooves after the Mechanical Run Test. Bearing journal areas of the turbine shaft shall be likewise checked.
    - b. Bearing case reassembled after inspection shall be protected with Mylar for bearing and shaft protection during shipment.
- F. Steam Surface Condenser (performed by manufacturer):
1. Tube side of the condenser, including water boxes, shall be pressure tested to 1.5 times the design working pressure.
  2. Pressure testing of the shell side shall use clean water.
  3. Testing shall be in accordance with ASME Section VIII Div. 1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine chillers before installation. Reject chillers that are damaged.
- B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.
  1. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CHILLER INSTALLATION

- A. Install chillers on support structure indicated.
- B. Equipment Mounting:
  - 1. Install chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Charge chiller with refrigerant and fill with oil if not factory installed.
- E. Install separate devices furnished by manufacturer and not factory installed.
- F. The vendor's chilled arrangement shall be capable of being installed on a site footprint of 21 feet (L) x 10 feet 6 inches (W) x 16 feet (H), with adequate clearances for chiller installation and maintenance. Required access and pull spaces that exceed these dimensions shall be defined.
- G. The chiller will have to be partially assembled in place, due to the rigging space available. Contractor is responsible for field erection of disassembled chiller. Supervision of the assembly, by a representative of the chiller manufacturer, shall be provided as part of the chiller purchase.

### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," and Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with flow control valve, thermometer, and plugged tee with shutoff valve and pressure gage. Connect to evaporator outlet with, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange or mechanical coupling.
- D. Condenser-Fluid Connections: Connect to condenser inlet with flow control valve, thermometer, and plugged tee with shutoff valve and pressure gage. Make connections to chiller with a flange or mechanical coupling, to match existing.
- E. Steam Condenser-Fluid Connections: Connect to condenser outlet. Make connections to chiller with a flange or mechanical coupling, to match existing.
- F. Refrigerant Pressure Relief Device Connections: For chillers installed indoors, extend vent piping to the outdoors via existing piping without valves or restrictions. Comply with

ASHRAE 15. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.

- G. Connect steam and condensate to chiller as shown on the P&ID.
- H. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
  - 3. Verify that pumps are installed and functional.
  - 4. Verify that thermometers and gages are installed.
  - 5. Check bearing lubrication and oil levels.
  - 6. Verify that refrigerant pressure relief device is vented outside.
  - 7. Verify proper turbine and compressor rotation.
  - 8. Verify proper turbine startup.
  - 9. Operate chiller for run-in period.
  - 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator, condenser, and steam condenser.
  - 11. Verify and record performance of chiller protection devices.
  - 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

### 3.5 FIELD ACCEPTANCE TEST

- A. Verification: The Manufacturer shall conduct a field acceptance test for the chiller. The test date shall be coordinated with the owner and the owner's representatives and the engineer of record shall be present for this testing. The test date will be seasonally and plant operations dependent, but will be scheduled at least 2 weeks in advance. **The purpose of the test is to demonstrate compliance with the submitted performance data.**
- B. The manufacturer shall prepare a report of all field test data and document compliance with the performance scheduled in the submittal and shall forward to the Owner and Engineer for review and approval.
- C. In addition to the contractual payment retention, 5% of the scheduled value of the chiller will be retained until Owner and Engineer acceptance of the field test report.
- D. The field performance will be accepted if the test procedures are in accordance with ARI 550/590 (including standard capacity and performance tolerances) and the results meet the

performance submitted. If the equipment fails to meet the submitted performance, the manufacturer will be allowed 60 calendar days to make necessary adjustments to the chiller and to re-test (with the same 2 week notice for all parties.) If the re-testing is not successfully completed within 60 days after the completion of the initial testing, the retained 5% will be forfeited by the vendor, as a penalty.

- E. The single point to be field tested on the chiller for the field acceptance test is full load, at the design conditions.
- F. Pressure Test: Provide 12 hour minimum refrigerant circuit standing pressure test at peak design refrigerant pressure to verify circuit integrity after installation.
- G. Manufacturer may use the project installed flow meters, temperature sensors and other devices, at Manufacturer's risk. Owner makes no claim regarding the accuracy of the installed devices on the project.
  - 1. Chilled and condenser water meters on the branches to the chiller are being installed as part of this contract.
  - 2. There is a common steam meter for the four steam turbine driven chillers. Coordinate with Operations to schedule the testing at a time when the chilled water load, above the 2100 tons on CH-8 for the test, can be shifted to the electric and gas engine driven chillers (approximately 4,000 tons); this will allow the existing steam meter to be dedicated to CH-8 for the testing.
  - 3. If the Manufacturer is not satisfied with the installed conditions or accuracy of the installed devices, the Manufacturer shall provide their own devices at no cost to the Owner.
  - 4. Owner will operate system during test conducted by manufacturer, and will provide for design conditions within ARI tolerances.
- H. All costs for testing (and re-testing) of the chillers will be the responsibility of the Manufacturer.

### 3.6 DEMONSTRATION

- A. Provide an outline of training to be provided 30 days in advance of training to the University. Training to include all aspects of operation and maintenance as performed during the startup and commissioning of the machine.
- B. Equipment supplier shall provide a factory trained and certified service representative to train University's maintenance personnel to adjust, operate, and maintain chillers. Video recorded training to include classroom and field training sessions, and shall be of sufficient quality for future viewing by operating personnel that did not attend the initial training.
  - 1. Allow for training for two shifts on site.
  - 2. Video recording will be provided by others.
- C. In addition, provide three days of classroom instruction at a location to be designated on the campus.

### 3.7 POST-STARTUP COMMISSIONING

- A. Contractor shall perform post-startup commissioning of installed systems and equipment per project documents.

### 3.8 SEPARATE ACTIVITIES

- A. Startup Service, the Field Acceptance Test, Demonstration and Post Startup Commissioning shall be separately scheduled independent activities.
- B. If requested in advance and acceptable to Operations, some of these activities can be consecutively scheduled; however, the Manufacturer and Contractor shall plan on each activity being a separately scheduled site visit.

END OF SECTION 236416

## SECTION 236500 - COOLING TOWERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Open-circuit, induced-draft, crossflow cooling towers.

#### 1.3 DEFINITIONS

- A. PCS: Plant control system.

#### 1.4 PERFORMANCE REQUIREMENTS

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
  - 1. Maximum flow rate.
  - 2. Minimum flow rate.
  - 3. Drift loss as percent of design flow rate.
  - 4. Sound power levels in eight octave bands for operation with fans off, fans at minimum, and design speed.
  - 5. Performance curves for the following:
    - a. Varying entering-water temperatures from design to minimum.
    - b. Varying ambient wet-bulb temperatures from design to minimum.
    - c. Varying water flow rates from design to minimum.
    - d. Varying fan operation (off, minimum, and design speed).
  - 6. Fan airflow, brake horsepower, and drive losses.
  - 7. Motor amperage, efficiency, and power factor at 100, 75, 50, and 25 percent of nameplate horsepower.
  - 8. Electrical power requirements for each cooling tower component requiring power.

- B. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation. Include the following:
  - 1. Assembled unit dimensions.
  - 2. Weight and load distribution.
  - 3. Required clearances for maintenance and operation.
  - 4. Sizes and locations of piping and wiring connections.
  - 5. Wiring Diagrams: For power, signal, and control wiring.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Structural supports.
  - 2. Piping roughing-in requirements.
  - 3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
  - 4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.
- B. Startup service reports.
- C. Warranty: Sample of special warranty.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cooling tower to include in operation and maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. CTI Certification: Cooling tower thermal performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."
- C. FMG approval and listing in the latest edition of FMG's "Approval Guide."

#### 1.9 COORDINATION

- A. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:
1. All components of cooling tower.
  2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 OPEN-CIRCUIT, INDUCED-DRAFT, CROSSFLOW COOLING TOWERS

- A. Products: Subject to compliance with requirements, provide Marley Cooling Technologies Model NC 8414, or approved equal.
- B. Cooling Tower structure, anchorage and all its components shall be designed by licensed professional engineers, employed by the manufacturer, per the International Building Code to withstand a wind load of 30 psf, as well as a 0.3g seismic load. The fan deck, hot-water basin covers and, where specified, maintenance platforms shall be designed for 60 psf live load or a 200 lb concentrated load. Guardrails, where specified, shall be capable of withstanding a 200 lb concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.
- C. Casing and Frame:
1. Casing and Frame Material: Galvanized steel, ASTM A 653/A 653M, G235 coating.
  2. Joints and Seams: Sealed watertight.
  3. Welded Connections: Continuous and watertight.
- D. Collection Basin:
1. Material: Type 304 Stainless steel.
  2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
  3. Overflow and drain connections.
  4. Makeup water connection.
  5. Outlet Connection: ASME B16.5, Class 150 flange.
  6. Equalizer connection for field-installed equalizer piping.
- E. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
1. Material: Type 304 Stainless steel.
  2. Location: Over each bank of fill with easily replaceable polypropylene spray nozzles mounted in bottom of basin.
  3. Inlet Connection: ASME B16.5, Class 150 flange.
  4. Joints and Seams: Sealed watertight.

5. Partitioning Dams or Distribtuion Nozzle Cups: Dams shall be same material as basin, cups shall be plastic, to distribute water over the fill to minimize icing or air path short circuit while operating at 60% of design flow.
  6. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable corrosion-resistant or stainless-steel hardware.
  7. Single-Inlet, Field Pipe Connection: PVC pipe arranged to provide balancing of flow within cooling tower cell without the need for additional balancing valves. Pipe each cooling tower cell internally to a single, field connection suitable for mating to ASME B16.5, Class 150 flange and located on the bottom.
- F. Fill:
1. Materials: PVC, with maximum flame-spread index of 25 according to ASTM E 84.
  2. Fabrication: Fill-type sheets, fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
  3. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F.
- G. Drift Eliminator:
1. Material: PVC; with maximum flame-spread index of 25 according to ASTM E 84.
  2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
  3. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
- H. Air-Intake Louvers:
1. Material: PVC.
  2. Location: Integral to fill material.
- I. Axial Fan: Balanced at the factory after assembly.
1. Blade Material: Aluminum.
  2. Hub Material: Aluminum.
  3. Blade Pitch: Field adjustable.
  4. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
  5. Blade Type: Low-noise, propeller-type.
- J. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
1. Gear Drive and Coupling Service Factor: 2.0 based on motor nameplate horsepower.
  2. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
  3. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
  4. Operation: Able to operate both forward and in reverse.
  5. Drive-to-Motor Connection: Close coupled to motor using a flexible coupling Connected to motor.

6. Drive Shaft Material: Corrosion resistant.
7. Extend oil fill, drain, and vent to outside of cooling tower casing using stainless steel piping. Provide installation with oil-level dip-stick.
8. Gear drive shall not require oil changes for the first five years of operation.

K. Fan Motor:

1. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment" and not indicated below.
2. Motor Enclosure: Totally enclosed fan cooled (TEFC) with epoxy or polyurethane finish.
3. Energy Efficiency: Comply with ASHRAE/IESNA 90.1, NEMA Premium Efficient.
4. Service Factor: 1.15.
5. Insulation: Cooling tower duty.
6. Variable-Speed Motors: Motors shall be inverter duty, suitable for variable speed operation. Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors." Variable speed drives will be specified for and provided separately.
7. Provide with heater, which is energized whenever fan is not running.

L. Fan Discharge Stack: Material shall match casing or FRP, velocity recovery design.

1. Stack Extension: Fabricated to extend above fan deck to match existing.
2. Stack Termination: Wire-mesh, galvanized-steel screens; complying with OSHA regulations, if stack is less than 5'-0".

M. Vibration Switch: For each fan drive.

1. Enclosure: NEMA 250, Type 4X.
2. Vibration Switch:
  - a. Metrix 440-SR-2-0-4-0-0-2-0, with 4-20 mA continuous output to the PCS and solid state relay (N.O. or N.C. field selectable) for connection to VFC fan power circuit.
  - b. Sensor with a field-adjustable, peak velocity set point in a range of 0 to 1.5 inches/second and frequency range of 2 to 1000 Hz.
  - c. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
  - d. Cooling tower manufacturer will provide switch and will mount switch to mechanical equipment support beam below gear box or directly on gear box.
3. Provide switch with manual-reset button for field connection to a PCS and hardwired connection to fan motor electrical circuit.
4. Switch shall, on sensing excessive vibration, signal an alarm on the PCS and shut down the fan directly at the VFD.

N. Gear-Drive, Oil-Level Switch: Low-oil-level warning switch for connection to PCS.

1. Switch shall, on reaching a low-oil-level set point recommended by cooling tower manufacturer, signal an alarm .

- O. Controls: Comply with requirements in Section 230900 "Instrumentation and Control for HVAC."
- P. Personnel Access Components:
  - 1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
  - 2. External Ladders with Safety Cages: Not required.
  - 3. External Platforms with Handrails: Galvanized-steel bar grating at fan deck level. Provide bridge to existing cell for access to new cell via existing ladder.
  - 4. Handrail: Galvanized steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
  - 5. Internal Platforms: Galvanized-steel bar grating.
    - a. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
    - b. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Before cooling tower installation, examine roughing-in for tower support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting tower performance, maintenance, and operation.
  - 1. Cooling tower locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install cooling towers on support structure indicated if providing tower matching existing. Contractor shall modify the existing support structure as necessary for towers not matching existing installation.
- B. Equipment Mounting:
  - 1. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 2. Maintain manufacturer's recommended clearances for service and maintenance.
- C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to cooling towers to allow service and maintenance.
- C. Provide drain piping with valve at cooling tower drain connections and at low points in piping.
- D. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.
- E. Supply and Return Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve. Make connections to cooling tower with a flange.
- F. Equalizer Piping: Connect to existing piping. Connect to cooling tower with shutoff valve.

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Obtain performance data from manufacturer.
  - 1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
    - a. Clean entire unit including basins.
    - b. Verify that accessories are properly installed.
    - c. Verify clearances for airflow and for cooling tower servicing.
    - d. Check for structural support.
    - e. Lubricate bearings.
    - f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
    - g. Verify proper oil level in gear-drive housing. Fill with oil to proper level. Check switch operation.
    - h. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
    - i. Check vibration switch setting. Verify operation.
    - j. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control.

- D. Start cooling tower and associated water pump. Follow manufacturer's written starting procedures.
- E. Prepare a written startup report that records the results of tests and inspections.

3.5 ADJUSTING

- A. Set and balance water flow to each tower inlet.
- B. Adjust water-level control for proper operating level.

END OF SECTION 236500

## SECTION 260100 - ELECTRICAL GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.
- B. Electrical equipment and installed systems shall be suitable for the intended application, shall be safe for the intended use, shall be fully rated for the available fault current, and shall conform to local building codes and statutory requirements.

#### 1.2 RELATED DOCUMENTS

- A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.3 SCOPE OF WORK

- A. The work includes, but is not limited to, the following:
  - 1. Basic electrical materials and methods
  - 2. Grounding and bonding
  - 3. Electrical identification
  - 4. Wire and cable
  - 5. Raceways, boxes, and fittings
  - 6. Cable trays
  - 7. Variable frequency controllers
  - 8. Enclosed switches and circuit breakers
  - 9. Motor control centers
  - 10. Field wiring for equipment provided under other Sections of the Specification
  - 11. Thorough cleaning of all equipment prior to energization
  - 12. Protection of all equipment under this Division until the final acceptance of the job
- B. Coordinate Division 26 requirements with work in other Divisions.
- C. Submit preconstruction submittals, shop drawings, product data, samples, design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, operation and maintenance data, closeout submittals and other specified documents to the Engineer for review and approval as described in Division 01, in this Section, and in other Sections of Division 26.
- D. Perform electrical acceptance tests described in other Division 26 Sections (Part 3).

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
  2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
  3. Humidity: Between 5 and 95 percent (noncondensing).
  4. Altitude: Not exceeding 3300 feet.

#### 1.5 DEFINITIONS

- A. In addition to the Definitions in Specification Division 01, the following definitions apply to Division 26:
1. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.
  2. ANSI: American National Standards Institute
  3. AEIC: Association of Edison Illuminating Companies
  4. ASQ: American Society for Quality
  5. AWG: American Wire Gauge
  6. CFR: Code of Federal Regulations
  7. Cable: an assembly of insulated conductors
  8. Control panel: an electrical enclosure housing control logic devices and an operator control interface
  9. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and de-bugging) and functional testing of individual pieces of equipment have all been completed
  10. Contract: as used in the Electrical Specification, includes all Contract documents including Specifications and Appendices, Drawings, Addenda, and Change Orders
  11. ICEA: Insulated Cable Engineers Association
  12. Equipment: a general term including materials, fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation (OSHA Section 29 CFR 1910.399(46) definition)
  13. FM: Factory Mutual, Inc.
  14. Field wiring: on-site installation of raceways & conductors to connect equipment in accordance with approved drawings
  15. Field test: electrical test carried out on-site
  
  16. Furnish and install: same as "Provide" below.
  17. Functional testing: verification of the satisfactory performance of control logic, with due attention to equipment protective devices, for example, overload relays, temperature switches, pressure switches, flow switches, and similar devices, under actual operating conditions
  18. IEEE: Institute of Electrical and Electronics Engineers, Inc.

19. ISO: International Standards Organization
20. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars, and including bus tie breaker sections and control sections
21. LV: low voltage, operating voltage under 600V (NEC definition)
22. Megger: insulation tester with megohm scale
23. NEC: NFPA 70, the National Electrical Code
24. NETA: InterNational Electrical Testing Association, Inc.
25. NICET: National Institute for Certification in Engineering Technologies
26. NFPA: National Fire Protection Association
27. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
28. Nonconformity: The nonfulfillment of a specified requirement (ASQ definition)
29. "Or approved equal": proposed "equal" product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers' products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
30. OSHA: Occupational Safety and Health Act
31. Panel: with respect to circuit breaker and fuse power distribution centers, panel is equivalent to "distribution board", e.g., lighting panel; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel
32. Provide: Throughout the Specification, use of this term includes project administration, quality assurance, human resources, tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, on-site supervision by equipment manufacturers' representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warranties, other work described in individual Sections of the Specification, and the Contractor's duties, responsibilities, risks, and liabilities under the Contract.
33. Punch list: document containing detailed descriptions of non-conformities
34. Quality: conformance to specified requirements.
35. RMS: root mean square
36. Raceways: cable ladder and tray, conduit, duct, wireway, and associated boxes and fittings which enclose, support, and protect wires and cables
37. Shop drawings: a complete package of manufacturer's equipment drawings, bill of materials, catalog data sheets, performance curves, calculations, and other data provided to demonstrate conformance to the equipment specification
38. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
39. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Specification requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.
40. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
41. UL: Underwriters Laboratories, Inc.

- 42. VFC: variable frequency controller
- 43. VFD: variable frequency drive, the combination of VFC and inverter-duty motor that drive mechanical loads using the principle of variable frequency motor control
- 44. Wiring: conductors and connections to equipment terminals. 'Wiring' and 'cabling' shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring.

## 1.6 REFERENCE STANDARDS

- A. Notwithstanding revision dates shown in this and other Sections of Division 26, the codes and standards applicable to this project shall be those in effect at the time of bid submittal, except for NFPA 70 NEC, which shall be the version acceptable to the AHJ.

## 1.7 QUALITY ASSURANCE

- A. In consultation with the equipment and materials Suppliers, the Contractor shall prepare and submit a Compliance Statement as described in "SUBMITTALS" below with each submittal requiring approval.
- B. The Engineer's approval of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Approval of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement that is specified to be included with each submittal, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer.
- C. Manufacturers of electrical equipment shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer.
- D. Equipment, materials, and installation shall conform to NEC requirements and shall be NRTL-listed and labeled.
- E. On-site testing prior to energization and electrical acceptance testing shall be performed as specified in other Sections.
- F. Manufacturers, manufacturer's representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Owner's Representative.

## 1.8 SAFETY IN THE WORKPLACE

- A. Electrical equipment and materials, and the Contractor's installation practices, shall conform to the following:
  - 1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
  - 2. NFPA 70, the National Electrical Code

3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces
  - B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.
  - C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer's standard offering for a particular product.
  - D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.
  - E. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

#### 1.9 WORKMANSHIP AND MATERIALS

- A. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.
- B. Materials and equipment shall be installed in accordance with the Drawings, the Specification, and the manufacturer's installation, operation, and maintenance instructions. In the event of apparent conflicts or discrepancies, the Engineer shall be informed of the apparent conflict or discrepancy through the RFI process.

#### 1.10 RESOURCES AND CONSTRUCTION SCHEDULE

- A. The Contractor shall provide sufficient resources, including qualified and experienced project managers, electrical engineers, superintendents, technicians, supervisors, electricians, tools and construction equipment to complete the electrical work in accordance with the activity durations and sequences shown on the Construction Schedule for this project.

#### 1.11 CONTRACT DRAWINGS

- A. The Electrical Drawings provide scaled layouts of representative equipment and key building dimensions, for example, structural gridlines, but do not include "approved for construction" dimensions for equipment.

#### 1.12 COORDINATION OF WORK

- A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the

plans and specifications prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.

- B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with NEC, and in all cases bring to the attention of the Engineer any discrepancies on the plans and in the specifications prior to installation. Any work that installed without proper coordination shall be removed and reinstalled at the Contractor's expense. The layout for sleeves, chases, openings, etc., must be arranged prior to construction in order to prevent unnecessary cutting. Examine Architectural drawings for doors swings, countertop heights, built-in furniture and casework, and other factors affecting electrical outlet locations prior to roughing-in raceways, boxes, fittings, and outlets.

#### 1.13 COORDINATION DRAWINGS

- A. Following approval of equipment shop drawings, the Contractor shall create dimensioned electrical equipment layout drawings, showing the relationships of approved electrical equipment with the building structural and architectural components, walls, floors, ceilings, doors, windows, louvers, access hatches, concrete equipment pads, and seismic anchors and bracing. One set of these Coordination Drawings shall be maintained at the construction site throughout the construction phase.

#### 1.14 CODES AND STANDARDS

- A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC) and all applicable portions of local codes, in accordance with the requirements of the AHJ.
- B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:
  - 1. American Association for Laboratory Accreditation (A2LA)
  - 2. American Society for Testing and Materials (ASTM)
  - 3. American National Standards Institute (ANSI)
  - 4. Americans with Disabilities Act (ADA)
  - 5. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
  - 6. Factory Mutual Engineering & Research (FME&R)
  - 7. Illuminating Engineering Society of North America (IESNA)
  - 8. Insulated Cable Engineers Association (ICEA)
  - 9. International Organization for Standardization (ISO)
  - 10. National Electrical Manufacturers Associates (NEMA)
  - 11. Institute of Electrical and Electronic Engineers (IEEE)
  - 12. National Fire Protection Association (NFPA)
  - 13. Occupational Safety and Health Act (OSHA)
  - 14. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

## 1.15 SUBMITTALS

- A. Compliance Statement: with each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.
- B. In the absence of contradictory instructions in Division 01 Section "Submittal Procedures", Shop Drawings and Coordination Drawings shall be marked with revision blocks to indicate status as follows:
1. FOR APPROVAL
  2. AS MANUFACTURED (incorporates Engineer's comments)
  3. AS BUILT / RECORD (incorporates on-site modifications)
- C. Coordination Drawings: Submit dimensioned layout and coordination drawings of electrical equipment room(s), generator room(s), and electrical equipment area(s) for approval sufficiently in advance to allow for review by the Engineer prior to starting related work, in accordance with the Construction Schedule.
- D. Product Data Sheets: Submit a list of manufacturers with catalog numbers and product data sheets for the following materials miscellaneous equipment, and obtain approval before the items in question are ordered or installed.
1. Raceways, Boxes, and Fittings
  2. Wire and Cable (600 V and less)
  3. Miscellaneous equipment including enclosed disconnect switches, enclosed circuit breakers, individually mounted combination motor starters, and control and pushbutton stations.
- E. Record Drawings: Maintain a full size paper set of "black-line" working drawings throughout the project, and shall carefully record in red ink the actual locations including dimensions to locate each piece of electrical equipment, raceways, boxes, & fittings, and electrical outlets. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Engineer. The Engineer reserves the right to withhold final payment until "As-Built" drawings are received.
- F. Operation and Maintenance Manuals: Prior to acceptance of the finished project, provide copies of electrical Operation and Maintenance Manuals in conformance with Division 01 Section "Operation and Maintenance Data". O&M Manuals shall be organized according to Division 26 Section numbers. Each copy shall be bound in a durable, 3-ring hardback binder, with data sheets individually punched and reinforced to prevent tearout. Data sheets shall be grouped, and binder dividers shall be provided to match the Table of Contents. Each Manual shall have an identifying label on the spine and front cover and shall include the following:
1. List of all O&M Manuals in the front of each manual.

2. Table of Contents for each manual and each binder
3. Copy of each of the following:
  - a. Preconstruction Submittals
  - b. Shop Drawings
  - c. Product Data
  - d. Design Data
  - e. Test Reports
  - f. Certificates
  - g. Manufacturer's Instructions
  - h. Manufacturer's Field Reports
  - i. Operation and Maintenance Data
  - j. Closeout Submittals

#### 1.16 OUTAGES

- A. Electrical outages: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service if required by the Specification.
  1. Notify the Owner a minimum of 30 days in advance of proposed interruption of electrical service.
  2. Submit step-by-step sequence and schedule for proposed interruption, and if required, proposed method of providing temporary electrical service, to the Owner for approval.
  3. Confirm approved interruption of electrical service one week in advance of Owner-approved date.
  4. Do not proceed with interruption of electrical service without written permission from the Owner.

### PART 2 - PRODUCTS AND EXECUTION

#### 2.1 EQUIPMENT AND MATERIALS

- A. Provide equipment and materials in compliance with other Sections of Division 26. The requirements in this Section apply to all Sections in Division 26.

#### 2.2 ELECTRICAL IDENTIFICATION

- A. Electrical equipment, raceways, boxes, fittings, wires and cables shall be marked in the field in accordance with Division 26 Section "Identification of Electrical Systems".

#### 2.3 ELECTRICAL ENCLOSURES

- A. In the absence of other specified NEMA enclosure ratings in other Sections of the Specification, electrical enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof) and environmental conditions. Electrical equipment enclosures shall have the following NEMA 250 ratings:

1. NEMA 1 or 1A: Enclosures located in clean, dry, indoor Control Rooms and Electrical Rooms shall be NEMA 1 painted steel, except that switchgear, switchboards, and motor control centers in clean, dry electrical rooms shall have foam gaskets on covers and doors (NEMA 1A) to reduce dust intrusion.
2. NEMA 4: Electrical enclosures located outdoors in non-corrosive areas and containing electrical equipment shall be NEMA 4 painted steel.
3. NEMA 4X: Outdoor enclosures in corrosive areas, including areas exposed to cooling tower mist, shall be NEMA 4X [**stainless steel**]
4. NEMA 12: Clean, dry process areas and mechanical equipment rooms
5. Where different enclosure ratings and enclosure materials are specified in other Sections of the Specification, the Contractor shall submit a written request for clarification of the intent of the Specification to the Engineer.

#### 2.4 ELECTROMAGNETIC INTERFERENCE

- A. Power conversion equipment, including variable frequency controllers, battery-powered inverters, computer power supplies, frequency converters, and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

#### 2.5 DISSIMILAR METALS

- A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper busbars, aluminum busbars, and copper-to-aluminum busbar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with grade 3 or better plated steel bolts, nuts, and washers. Belleville washers & tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum busbar joints.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Owner's Representative.

### PART 3 - EXECUTION

#### 3.1 DELIVERY AND HANDLING

- A. Equipment delivered to site shall be handled in accordance with manufacturer's recommendations by experienced riggers, crane operators, and fork lift truck operators.

### 3.2 STORAGE AND PROTECTION OF EQUIPMENT

- A. All electrical equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Switchgear, unit substations, motor controllers, panelboards, emergency lighting, solid state equipment, engine generator shall be stored in a clean, dry, indoor location, under cover, until the building is weathertight and the area where the equipment is to be installed has been completed to the satisfaction of the Engineer, including completion of overhead work by other trades.
- B. Anti-condensation heaters shall be energized during storage. Long term storage instructions of the manufacturer shall be followed.
- C. Equipment with anti-condensation heaters shall have the 120VAC anti-condensation heaters energized from temporary 120VAC supplies as soon the factory packaging has been opened.
- D. Equipment enclosures exposed to construction damage such as paint spots, spackling, waterproofing, insulation etc. shall be covered and protected against damage.

### 3.3 ON-SITE INSPECTIONS AND NONCONFORMITIES

- A. Equipment shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.
- B. Installed equipment, raceways, and wiring shall be inspected on completion of installation for compliance with the Specification and approved installation drawings.
- C. A Punch List will be prepared by the Owner's Representative during inspections and testing, and issued to the Contractor for corrective action.
- D. Repairs, replacement, and other corrective action that requires de-energizing any part of the Electrical Power Distribution and Control System shall be completed prior to the scheduled date for substantial completion of the project.

### 3.4 PENETRATIONS AND SEALING

- A. Sleeves and rectangular openings shall be provided for raceways provided under this Contract, and for raceways for future equipment where future equipment is shown on the Drawings. Sleeves and rectangular openings for the passage of raceways and conductors shall be sealed after the raceways and conductors have been installed. Spare sleeves and rectangular openings shall also be sealed.
- B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction, including roofs and exterior walls. Where penetrations are necessary, provide sleeves and sealing fittings to make each penetration watertight. Conduit sleeves and openings shall be sealed watertight with mechanical seals. Watertightness shall not rely on caulking.

- C. Penetration of Fire-Rated Construction: Sleeves and openings in fire-resistant walls and floors for electrical raceways, wires, and cables shall be sealed after installation of the raceways, wires, and cables with NRTL-certified fire penetration seals, sealant, and fire-rated foam filler products to the same degree of fire resistance (e.g., 1, 2, or 4 hours) as the adjacent walls and floors, and to the satisfaction of the AHJ. Where both fire sealing and water sealing is required, mechanical seals with NRTL-listed fire-resistant properties shall be used. Fire sealants shall be compatible with the cable jacket and wire insulation materials. Manufacturer's certification of compatibility shall be provided at the request of the Engineer. For additional requirements, refer to Division 26 Section "Raceways and Boxes for Electrical Systems".

### 3.5 ALTERATIONS AND REMOVAL OF EXISTING WORK

- A. Where the work specified under this Division connects to the existing electrical systems, the Contractor shall perform all necessary alterations to the existing work as required.
- B. All work performed on the existing electrical systems shall be in accordance with the applicable provisions of the Specification. Visit the project site prior to submitting bids and examine the conditions in which work will be performed. Carefully document all existing conditions pertaining to removal and demolition work.
- C. Contractor shall make connections to existing equipment where indicated on the Drawings.
- D. All existing electrical materials not reused under this Division, and not indicated for handover to the Owner, shall become the property of the Contractor and shall be expeditiously removed from the project site.
- E. While performing connections and alterations to existing electrical work, the Contractor shall take special care to protect all existing equipment from dirt, debris and damage. Damaged equipment shall be replaced at no additional cost to the Owner.
- F. All removal work shall be performed in a neat and workmanlike manner and shall be executed with the least possible disturbance to the building and tenants. The scheduling of all removal work shall be coordinated with other trades and with the Owner's schedule and operation of the building.
- G. Where removal work is performed, the Contractor shall repair all building surfaces damaged by such work. Cut back embedded conduits to 2 inches minimum below finished face of walls, floor, and ceilings, and fill in holes with appropriate patching material. Repair, re-tile, replace (in the case of ceiling panels) or re-paint to match existing adjacent surfaces.
- H. Provide electrical safety equipment, including personal protective equipment, hot sticks, HV gloves, electrical blankets, test instruments, lighting, ventilation, and instructions in the use of safety equipment, and perform the work under this Contract in accordance with applicable safety rules and regulations. The Contractor's attention is directed to safety issues related to confined spaces as defined in OSHA regulations.
- I. One numbered safety lockout padlock with an 'unlawful-to-duplicate' unique key shall be provided for each motor controller. Safety lockouts shall be used during testing and commissioning, and shall subsequently be handed over to the Owner in a lockable sheet metal

key cabinet. The safety lockout padlock supplier shall be a specialist supplier with a registered key program.

### 3.6 CLEANING AND PAINTING

- A. After installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure and motor by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.
- B. Clean and remove all rust, scale, oil, grease, and dirt from panelboard enclosures, conduits, pull, junction and terminal boxes, fittings and hangers, leaving surfaces in condition for final surface preparation and painting.
- C. All ferrous materials that are concealed, or exposed in unfinished areas, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted under this Section with one coat of zinc-chromate primer and one finish coat of enamel paint approved by the Engineer. Nonferrous materials shall be cleaned only and left unpainted.
- D. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall be match the color and type of the original finish.

### 3.7 INSPECTION AND TESTING ON-SITE

- A. The Contractor shall hire a NETA-certified or NICET-certified specialist electrical testing firm to perform on-site inspection and electrical testing.
- B. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Standards as described in individual Division 26 Sections, Part 3.
- C. Submit manufacturer-endorsed field test data sheets & procedures for approval, test equipment and materials on-site prior to site visit by manufacturer's factory-trained representative, test equipment on-site under the supervision of the Engineer and the equipment manufacturer's factory-trained representative(s), and submit manufacturer's statement of acceptance of installation prior to energization of equipment. Invite the Engineer's and Owner's representatives to witness field testing.
- D. Electrical equipment shall not be energized without the approval of the Engineer.
- E. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.
- F. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

END OF SECTION 260100

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Building wires and cables rated 600 V and less.
- 2. Connectors, splices, and terminations rated 600 V and less.

- B. Related Requirements:

- 1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

#### 1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Comply with ANSI WC70/ICEA S-95-658

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Alcan Products Corporation; Alcan Cable Division.
  2. Encore Wire Corporation.
  3. General Cable Technologies Corporation.
  4. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type XHHW-2.
- D. VFC Cable:
1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
  2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire and sunlight- and oil-resistant outer PVC jacket.

### 2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
  2. Gardner Bender.
  3. Hubbell Power Systems, Inc.
  4. Ideal Industries, Inc.
  5. IlSCO; a branch of Bardes Corporation.
  6. NSi Industries LLC.
  7. O-Z/Gedney; a brand of the EGS Electrical Group.
  8. 3M; Electrical Markets Division.
  9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable which shall be extra flexible stranded.

### 3.2 CONDUCTOR INSULATION, CABLE APPLICATIONS AND WIRING METHODS

- A. Feeder and Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway; Type XHHW-2, single conductors in raceway
- B. Feeder and Branch Circuits in Cable Tray: Type THHN-2-THWN-2, single conductors in raceway; Type XHHW-2, single conductors larger than No. 1/0 AWG
- C. NFPA 70 restricts use of exposed Type NM cable in some types of construction. See NFPA 70, Article 334, for complete listing of restrictions.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- E. VFC Output Circuits: Type TC-ER cable with braided shield.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- F. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

## SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Multimode optical-fiber cabling.
  - 2. UTP cabling.
  - 3. RS-485 cabling.
  - 4. Low-voltage control cabling.
  - 5. Control-circuit conductors.
  - 6. Identification products.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- D. RCDD: Registered Communications Distribution Designer.
- E. UTP: Unshielded twisted pair.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- C. Source quality-control reports.
- D. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ADC.
  - 2. Alpha Wire Company; a division of Belden Inc.
  - 3. Belden Inc.
  - 4. CommScope, Inc.
  - 5. Draka Cableteq USA.
  - 6. Genesis Cable Products; Honeywell International, Inc.
  - 7. Mohawk; a division of Belden Inc.
  - 8. Nexans; Berk-Tek Products.
  - 9. Siemon Company (The).
  - 10. Superior Essex Inc.
  - 11. SYSTIMAX Solutions; a CommScope, Inc. brand.
  - 12. 3M.
  - 13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, four-pair UTP covered with a thermoplastic jacket.
  - 1. Comply with ICEA S-102-700 for mechanical properties of Category 6 cables.
  - 2. Comply with TIA-568-C.1 for performance specifications.
  - 3. Comply with TIA-568-C.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NEMA WC 66, UL 444, and NFPA 70 for the following types:
    - a. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
    - b. Communications, Riser Rated: Type CMR complying with UL 1666 and ICEA S-103-701.
    - c. Communications, General Purpose: Type CM or Type CMG.

## 2.3 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ADC.
  2. American Technology Systems Industries, Inc.
  3. Belden Inc.
  4. Dynacom Inc.
  5. Hubbell Incorporated.
  6. Leviton Commercial Networks Division.
  7. Molex Premise Networks; a division of Molex, Inc.
  8. Panduit Corp.
  9. Siemon Company (The).
  10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Jacks and Jack Assemblies: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.1.
- E. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  2. Patch cords shall have color-coded boots for circuit identification.

## 2.4 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
  2. Fluorinated ethylene propylene insulation.
  3. Unshielded.
  4. Fluorinated ethylene propylene jacket.
  5. Flame Resistance: NFPA 262.

## 2.5 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 18 AWG, stranded tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: Comply with NFPA 262.

## 2.6 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Encore Wire Corporation.
  2. General Cable Technologies Corporation.
  3. Southwire Company.
- B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 83.
- C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway or power-limited tray cable, in cable tray, complying with UL 83.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway or power-limited tray cable, in cable tray, complying with UL 83.

## 2.7 SOURCE QUALITY CONTROL

- A. Factory test UTP cables according to TIA-568-C.2.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Test cables on receipt at Project site.
1. Test each pair of UTP cable for open and short circuits.

### 3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
1. Flexible metal conduit shall not be used.

- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Extend conduits 3 inches above finished floor.
  - 4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C Series of standards.
  - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems".
  - 3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets terminals.
  - 4. Cables may not be spliced.
  - 5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Install lacing bars and distribution spools.
  - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
  - 9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Monitor cable pull tensions.
  - 10. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. UTP Cable Installation:
  - 1. Comply with TIA-568-C.2.
  - 2. Do not untwist UTP cables more than 1/2 inch at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Optical-Fiber Cable Installation:

1. Comply with TIA-568-C.3.
2. Terminate cable on connecting hardware that is rack or cabinet mounted.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

### 3.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

### 3.6 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."

- C. Comply with BICSI TDMM, "Firestopping" Chapter.

### 3.7 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.8 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

### 3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
  - 1. Visually inspect UTP materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- E. Prepare test and inspection reports.

END OF SECTION 260523

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Dossert; AFL Telecommunications LLC.
  - 3. ERICO International Corporation.
  - 4. Fushi Copperweld Inc.
  - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.

6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

## 2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install stranded conductors, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
  2. Receptacle circuits.
  3. Three-phase motor and appliance branch circuits.
  4. Flexible raceway runs.
  5. Armored and metal-clad cable runs.
  6. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Report measured ground resistances that exceed the following values:
  - 1. Individual ground rod: 10 ohms.

- G. Excessive Ground Resistance: If resistance to ground exceeds specified value(s), drive rods deeper with a connecting rod. If driving the rods to twice the original depth does not yield specified values, notify the Engineer and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.

#### 1.3 DEFINITIONS

- A. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
- B. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

## 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Atkore International.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1) Cooper B-Line, Inc.
  - 2) Empire Tool and Manufacturing Co., Inc.
  - 3) Hilti, Inc.
  - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
  - 5) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slot support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits. Secure raceways and cables to these supports with two-bolt conduit clamps .
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 6. To Light Steel: Sheet metal screws.
  - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits, tubing, and fittings.
  - 3. Surface raceways.
  - 4. Boxes, enclosures, and cabinets.

#### 1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. RTRC: Reinforced Thermosetting Resin Conduit (fiberglass conduit).

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- C. Source quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- F. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. RTRC Manufacturers:
1. Champion Fiberglass, Inc.
  2. FRE Composites, Inc.
  3. Smith Fiberglass Products
  4. United Fiberglass of America, Inc.
- B. Fiberglass Conduit: Conduit shall be available in diameters 1 inch to 6 inches and shall be UL listed for use above and below ground. The resin system shall be epoxy based using an anhydride curing agent. The permitted fiberglass shall possess continuous E-glass roving. All additives for increasing flame spread and lowering smoke density must be halogen free (i.e. must not contain chloride or bromine). Carbon black shall be used as ultra violet inhibitor to protect conduit during storage and if or when it is exposed outside. Comply with UL 1684.
- C. Fittings and Accessories: All fittings, elbows, and accessories shall be manufactured from the same process, using the same methods and chemicals as the pipe. The exceptions are plastic duct plugs and access fittings (often referred to as nondalet fittings). Access fittings shall be

made from fire retardant vinylester materials, halogen free, must be hot compression molded and shall have couplings attached to the body of the access fittings.

D. Fiberglass Conduit Joining System:

1. Epoxy System: The conduit shall be supplied with an integral wound bell on one end and a machined end spigot on the other end. A two component epoxy adhesive shall be applied to the spigot end before joining the conduit together. The adhesive shall be supplied in 20 fl. oz. plastic cartridges, using a plastic static mixer attached to the cartridges and be applied with an adhesive gun. The adhesive shall be available for three different ambient temperatures, 70°F, 40°F and 20°F. The adhesive will applied by using an adhesive gun. Adhesive shall be supplied from the same manufacturer of conduit and fittings in order not to void the listing by UL.
2. Gasketed System: The conduit shall be supplied with a gasketed joining system can be used for both encased in concrete as well as direct buried installations. The gasketed shall be a three-ribbed gasket made from water resistant rubber material. The gasket shall be fit into a permanent groove in the belled end of the conduit. Retainer rings etc. are not permitted in order to create the groove.

## 2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect and shall be suitable for field repainting to match surroundings.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Mono-Systems, Inc.
    - b. Panduit Corp.
    - c. Wiremold / Legrand.
    - d. Thomas & Betts.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Adalet.
  2. Cooper Technologies Company; Cooper Crouse-Hinds.
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. FSR Inc.
  6. Hoffman.
  7. Hubbell Incorporated.

8. Kraloy.
  9. Milbank Manufacturing Co.
  10. Mono-Systems, Inc.
  11. O-Z/Gedney.
  12. RACO; Hubbell.
  13. Robroy Industries.
  14. Spring City Electrical Manufacturing Company.
  15. Stahlin Non-Metallic Enclosures.
  16. Thomas & Betts Corporation.
  17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep
- G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- H. Cabinets:
1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: RTRC
  2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  3. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed: GRC.
  - 2.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures: NEMA 250, Type 12, except use NEMA 250, Type 4 in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
  - 3. Fiberglass Conduits: Use only fittings listed for use with that material. Use sealant recommended by fitting manufacturer.
- E. Install surface raceways only where indicated on Drawings.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Surface Raceways:
  - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
  - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- Q. Comply with manufacturer's written instructions for solvent welding RFR and fittings.
- R. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground RTRC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  - 2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
  - S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
  - U. Locate boxes so that cover or plate will not span different building finishes.
  - V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
- 3.5 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.
    1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

## SECTION 260536 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Channel cable trays.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
  - 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
- C. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
  - 2. Vertical and horizontal offsets and transitions.
  - 3. Clearances for access above and to side of cable trays.
  - 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
- D. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

## 2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
  1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:
  1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
  2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
  3. Load and Safety Factors: Applicable to both side rails and rung capacities.

## 2.3 CHANNEL CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Allied Tube & Conduit; a Tyco International Ltd. Co.
  2. Chalfant Manufacturing Company.
  3. Cooper B-Line, Inc.
  4. Mono-Systems, Inc.
  5. MP Husky.
  6. Niedax-Kleinhuis USA, Inc.
- B. Description:
  1. Configuration: Two longitudinal members (side rails) with flat ventilated bottom. All fittings shall not be ventilated.
  2. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
  3. Minimum Usable Load Depth: 1.5 inches
  4. Straight Section Lengths: 12 feet except where shorter lengths are required to facilitate tray assembly.
  5. Width: 6 inches unless otherwise indicated on Drawings.
  6. Fitting Minimum Radius: 12 inches.
  7. Class Designation: Comply with NEMA VE 1, Class 12A
  8. Splicing Assemblies: Bolted type using serrated flange locknuts.
  9. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
  10. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

## 2.4 MATERIALS AND FINISHES

### A. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
2. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

## 2.5 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

## PART 3 - EXECUTION

### 3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Install cutouts to existing cable tray covers as indicated on the drawings.
- E. Remove burrs and sharp edges from cable trays.
- F. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.
- G. Fasten cable tray supports to building structure.
- H. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems."

- I. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- J. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- K. Support bus assembly to prevent twisting from eccentric loading.
- L. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- M. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- N. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- O. Make changes in direction and elevation using manufacturer's recommended fittings.
- P. Make cable tray connections using manufacturer's recommended fittings.
- Q. Install cable trays with enough workspace to permit access for installing cables.
- R. Install barriers to separate cables of different systems, such as power, control, and instrumentation; or of different insulation levels, such as 600, 5000, and 15 000 V.
- S. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- T. Clamp covers on cable trays installed outdoors with heavy-duty clamps.
- U. Install warning signs in visible locations on or near cable trays after cable tray installation.

### 3.2 CABLE TRAY GROUNDING

- A. Cable trays shall be bonded together with a #4/0 bare copper grounding conductor run in the tray along with the tray and bonded to the tray at two locations on each tray section.. Connect grounding conductor to building ground system at each end of the tray.

### 3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

- C. Fasten cables on vertical runs to cable trays every 18 inches.
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.
- E. In existing construction, remove inactive or dead cables from cable trays.
- F. Ethernet and RS-485 communication cables shall not be installed in cable tray.

### 3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
  - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
  - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
  - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
  - 7. Check for improperly sized or installed bonding jumpers.
  - 8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
  - 9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Protect cables from damage when penetrating cable tray cover.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
4. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 260536

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on a white field.
  - 2. Legend: Indicate voltage and system.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

### 2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

- E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

### 2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

### 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Metal-Backed, Butyrate Warning Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal size, 10 by 14 inches.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

### 2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

### 2.6 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black except where used for color-coding.

### 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

#### 3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways, 600 V or Less, for Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with wrap around label. Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the systems with self-adhesive vinyl labels with the wiring system legend and system voltage.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes,, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for feeder and branch-circuit conductors.

- a. Color shall be factory applied
  - b. Colors for 208/120-V Circuits:
    - 1) Phase A: Black.
    - 2) Phase B: Red.
    - 3) Phase C: Blue.
  - c. Colors for 480/277-V Circuits:
    - 1) Phase A: Brown.
    - 2) Phase B: Orange.
    - 3) Phase C: Yellow.
  - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes,, use preprinted heat shrink labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.

- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label .
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  - 2. Equipment to Be Labeled:
    - a. Enclosures and electrical cabinets.
    - b. Motor-control centers.
    - c. Enclosed switches.
    - d. Enclosed circuit breakers.
    - e. Variable-speed controllers.
    - f. Push-button stations.
    - g. Monitoring and control equipment.

END OF SECTION 260553

## SECTION 262419 - MOTOR-CONTROL CENTERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes MCCs for use with ac circuits rated 600 V and less . All MCCs have already been installed. Two vertical sections will be added to an existing MCC. All equipment is to be located indoors.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CE: Conformance Europeene (European Compliance).
- C. CPT: Control power transformer.
- D. EMI: Electromagnetic interference.
- E. GFCI: Ground fault circuit interrupting.
- F. IGBT: Insulated-gate bipolar transistor.
- G. LAN: Local area network.
- H. LED: Light-emitting diode.
- I. MCC: Motor-control center.
- J. MCCB: Molded-case circuit breaker.
- K. MCP: Motor-circuit protector.
- L. NC: Normally closed.
- M. NO: Normally open.
- N. OCPD: Overcurrent protective device.
- O. PCC: Point of common coupling.

- P. PID: Control action, proportional plus integral plus derivative.
- Q. PT: Potential transformer.
- R. PWM: Pulse-width modulated.
- S. RFI: Radio-frequency interference.
- T. SCR: Silicon-controlled rectifier.
- U. TDD: Total demand (harmonic current) distortion.
- V. THD(V): Total harmonic voltage demand.
- W. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each MCC, manufacturer's approval and production drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
  - 1. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Factory-installed devices.
    - c. Enclosure types and details.
    - d. Nameplate legends.
    - e. Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
    - f. Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
    - g. Specified optional features and accessories.
  - 2. Schematic Wiring Diagrams: For power, signal, and control wiring for each installed controller.
  - 3. Nameplate legends.
  - 4. Vertical and horizontal bus capacities.
  - 5. Features, characteristics, ratings, and factory settings of each installed unit.
- C. Standard Drawings: For each MCC, as defined in UL 845.
- D. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are

prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

- E. Qualification Data: For qualified testing agency.
- F. Product Certificates: For each MCC, from manufacturer.
- G. Source quality-control reports.
- H. Field quality-control reports.
- I. Warranty: Sample of special warranty.
- J. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
  - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  - 3. Manufacturer's written instructions for setting field-adjustable overload relays.
  - 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.
  - 5. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
  - 6. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
- K. Furnish extra materials described below that match GE Evolution Series E900 products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
  - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
  - 3. Indicating Lights: Two of each type and color installed.
  - 4. Auxiliary Contacts: Furnish one spare for each size and type of magnetic controller installed.
  - 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle MCCs according to the following:
  1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
  2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."
- B. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; connect factory-installed space heaters to temporary electrical service.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
  2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
  3. Humidity: Between 5 and 95 percent (noncondensing).
  4. Altitude: Exceeding 6600 feet, or 3300 feet if MCC includes solid-state devices.
- B. Interruption of Existing Electrical Service or Distribution Systems: Do not interrupt electrical service to, or distribution systems within, a facility occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
  1. Notify Owner no fewer than three days in advance of proposed interruption of electrical service.
  2. Indicate method of providing temporary electrical service.
  3. Do not proceed with interruption of electrical service without Owner's written permission.
  4. Comply with NFPA 70E.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

## 1.8 COORDINATION

- A. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace equipment that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. General Electric Company; GE Industrial Systems.
- B. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845.
- C. New MCC Sections shall be compatible for connection to existing GE Evolution Series E900 MCC and match existing vertical section dimensions.

### 2.2 FUNCTIONAL FEATURES

- A. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.
- B. Controller Units: Combination controller units.
  - 1. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
  - 2. Equip units in Type B and Type C MCCs with pull-apart terminal strips for external control connections.

- C. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
- D. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.
- E. Spare Units: Installed in compartments indicated "spare."

## 2.3 COMBINATION CONTROLLERS

### A. Full-Voltage Controllers:

- 1. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- 2. Magnetic Controllers: Full voltage, across the line, electrically held.
  - a. Configuration: Nonreversing.

### B. Reduced-Voltage, Solid-State Controllers:

- 1. General Requirements for Reduced-Voltage, Solid-State Controllers: Comply with UL 508.
- 2. Reduced-Voltage, Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium-induction motors.
  - a. Configuration: Standard duty; nonreversible.
  - b. Starting Mode: Field selectable.
  - c. Stopping Mode: Field selectable.
  - d. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
  - e. Shorting Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating.
  - f. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
  - g. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
  - h. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration without external feedback from the motor or driven equipment.
  - i. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
  - j. Adjusting motor full-load amperes, as a percentage of the controller's rating.

- k. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
- l. Adjusting linear acceleration and deceleration ramps, in seconds.
- m. Initial torque, as a percentage of the nominal motor torque.
- n. Adjusting torque limit, as a percentage of the nominal motor torque.
- o. Adjusting maximum start time, in seconds.
- p. Adjusting voltage boost, as a percentage of the nominal supply voltage.
- q. Selecting stopping mode, and adjusting parameters.
- r. Selecting motor thermal-overload protection class between 5 and 30.
- s. Activating and de-activating protection modes.
- t. Selecting or activating communications modes.
- u. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
- v. Controller Condition: Ready, starting, running, stopping.
- w. Motor Condition: Amperes, voltage, power factor, power, and thermal state.
- x. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
- y. Controller Diagnostics and Protection:
- z. Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor overload alarm and trip; settings selectable via the keypad.
- aa. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
- bb. Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component, or when the motor is stopped.
- cc. Remote Output Features:
- dd. All outputs prewired to terminal blocks.
- ee. Form C status contacts that change state when controller is running.
- ff. Form C alarm contacts that change state when a fault condition occurs.
- gg. Optional Features:
- hh. Analog output for field-selectable assignment of motor operating characteristics; 4 to 20-mA dc.
- ii. Additional field-assignable Form C contacts for alarm outputs.
- jj. Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
- kk. Full-voltage bypass contactor operating automatically. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.

C. Disconnecting Means and OCPDs:

- 1. MCCB Disconnecting Means:
  - a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
  - b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 200 A and larger.

- c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
  - d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
  - e. NC alarm contact that operates only when MCCB has tripped.
- D. Overload Relays:
1. Solid-State Overload Relays:
    - a. Switch or dial selectable for motor running overload protection.
    - b. Sensors in each phase.
    - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    - d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
    - e. Analog communication module.
  2. NC isolated overload alarm contact.
  3. External overload reset push button.

## 2.4 FEEDER-TAP UNITS

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 200 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

## 2.5 ENCLOSURES

- A. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 1 or Type 12 unless otherwise indicated to comply with environmental conditions at installed location.
- B. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- C. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.

- D. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.
- E. Wiring Spaces:
  - 1. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
  - 2. Horizontal wireways bottom and top of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

## 2.6 AUXILIARY DEVICES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
  - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy -duty type.
    - a. Pilot Lights: LED type.
- B. NO contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- E. Terminals for connecting power factor correction capacitors to the load side of overload relays.
- F. Spare control-wiring terminal blocks; wired.
- G. Spare-Fuse Cabinet: Identified cabinet with hinged lockable door.
- H. Bus Slice Kit: Comply with Manufacturer recommendation for splicing kits, components, and methodology. Bus shall maintain a continuous rating throughout MCC.

## 2.7 CHARACTERISTICS AND RATINGS

- A. Wiring: NEMA ICS 18, Class II, Type B
- B. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
- C. Nominal System Voltage: 480 V, three-phase, three-wire.
- D. Short-Circuit Current Rating of MCC: Fully rated with its main overcurrent device; 65 kAIC.

- E. Environmental Ratings:
  - 1. Ambient Temperature Rating: Not less than 0 deg F and not exceeding 104 deg F, with an average value not exceeding 95 deg F over a 24-hour period.
  - 2. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
  - 3. Humidity Rating: Less than 95 percent (noncondensing).
  - 4. Altitude Rating: Not exceeding 6600 feet, or 3300 feet if MCC includes solid-state devices.
- F. Main-Bus Continuous Rating: 1200A.
- G. Vertical-BusContinuous Rating: 600 A.
- H. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): 65 kAIC.
- I. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections.
- J. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.
- K. Phase-Bus Material: Hard-drawn copper of 98 percent conductivity, silver plated.
- L. Ground Bus: For entire length of the motor control center hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit equipment grounding conductors.
- M. Front-Connected, Front-Accessible MCCs:
  - 1. Controller Units: Fixed mounted.
  - 2. Feeder-Tap Units: Drawout and fixed mounted.
  - 3. Sections front and rear aligned.
- N. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

## 2.8 SOURCE QUALITY CONTROL

- A. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18.
- B. MCCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Floor-Mounting Controllers: Install MCCs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- E. Comply with NECA 1.

#### 3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification of MCC, MCC components, and control wiring.
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label MCC and each cubicle with engraved nameplate.
  - 3. Label each enclosure-mounted control and pilot device.

4. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

- B. Operating Instructions: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.

### 3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
  1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
  2. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.5 CONNECTIONS

- A. Comply with requirements for installation of conduit in Section 260533 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
  1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
9. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.

F. Enclosed controllers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
- C.
- D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

### 3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers.

END OF SECTION 262419

## SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

#### 1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

#### 1.6 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

#### 1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses per manufacturer recommendation, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
  2. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  3. Lugs: Mechanical type, suitable for number, size, and conductor material.

### 2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  3. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 200 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application.
  - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - 5. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.
  - 6. Accessory Control Power Voltage: Integrally mounted, self-powered.

## 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 122.
  - 2. Outdoor Locations: NEMA 250, Type 4X.
  - 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. All new breakers shall be inspected by the Office of Fire Marshal & Building Inspector (OFMBI). Coordinate shutdown and inspection with the Plant and OFMBI.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

## SECTION 262923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CE: Conformance Europeene (European Compliance).
- C. CPT: Control power transformer.
- D. EMI: Electromagnetic interference.
- E. LED: Light-emitting diode.
- F. NC: Normally closed.
- G. NO: Normally open.
- H. OCPD: Overcurrent protective device.
- I. PID: Control action, proportional plus integral plus derivative.
- J. RFI: Radio-frequency interference.
- K. VFC: Variable-frequency motor controller.

#### 1.4 SUBMITTALS

- A. Product Data: For each type and rating of VFC indicated.
  - 1. Include dimensions and finishes for VFCs.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For each VFC indicated.
  - 1. Include mounting and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Required working clearances and required area above and around VFCs.
  - 2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
  - 3. Show support locations, type of support, and weight on each support.
  - 4. Indicate field measurements.
- D. Qualification Data: For testing agency.
- E. Product Certificates: For each VFC from manufacturer.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Manufacturer's written instructions for setting field-adjustable overload relays.
    - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    - c. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
    - d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
    - e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.
- B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and connect factory-installed space heaters to temporary electrical service.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: All VFCs shall be ABB model ACS800. No substitutions are permitted.

#### 2.2 SYSTEM DESCRIPTION

- A. General Requirements for VFCs:
  1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A.
- B. Application: Variable torque.
- C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
  2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors."
  3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- F. Unit Operating Requirements:
1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
  2. Input AC Voltage Unbalance: Not exceeding 3 percent.
  3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
  4. Minimum Efficiency: 97 percent at 60 Hz, full load.
  5. Minimum Displacement Primary-Side Power Factor: 95 percent under any load or speed condition above 10 percent.
  6. Minimum Short-Circuit Current (Withstand) Rating: **65kA**.
  7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
  8. Humidity Rating: Between 5 and 95 percent (noncondensing).
  9. Altitude Rating: Not exceeding 3300 feet.
  10. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
  11. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
  12. Speed Regulation: Plus or minus 10 percent.
  13. Output Carrier Frequency: Selectable; Comply with manufacturer recommended limitations.
  14. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
  15. Inverter Logic: Microprocessor based isolated from all power circuits.
- G. Self-Protection and Reliability Features:
1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
  3. Under- and overvoltage trips.
  4. Inverter overcurrent trips.
  5. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
  6. Critical frequency rejection, with selectable, adjustable deadbands.
  7. Instantaneous line-to-line and line-to-ground overcurrent trips.
  8. Loss-of-phase protection.
  9. Reverse-phase protection.
  10. Short-circuit protection.
  11. Motor-overtemperature fault.
- H. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- I. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- J. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- K. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
  2. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
  3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

## 2.3 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.
  2. Run.
  3. Overvoltage.
  4. Line fault.
  5. Overcurrent.
  6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
  2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
    - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
  2. Motor speed (rpm).
  3. Motor status (running, stop, fault).
  4. Motor current (amperes).
  5. Motor torque (percent).
  6. Fault or alarming status (code).
  7. PID feedback signal (percent).
  8. DC-link voltage (V dc).
  9. Set point frequency (Hz).
  10. Motor output voltage (V ac).
- D. Discrete Inputs: A minimum of six independently programmable discrete inputs shall be provided.
- E. Discrete Outputs: A minimum of two independently programmable form C relay contacts shall be provided.
- F. Analog Inputs:
1. A minimum of two independently programmable analog inputs shall be provided:
    - a. At least one must support bi-polar voltage.
- G. Analog Outputs: A minimum of two independently programmable 0/4-20mA analog outputs shall be provided.
- H. Hardwired Interface and Communication Interface: VFCs shall be capable of communication via an Ethernet communications link. The VFC hardwired interface shall be used for data acquisition only.
1. Hardwired Points:
    - a. Start/Stop Dry Contact Input
    - b. Speed Signal Input: 4-20mA
    - c. Motor Current Feedback: 4-20mA
    - d. Fault Dry Contact Output: Rated for 120VAC

2. Communication Interface:
  - a. Interface modules shall be provided to communicate over Ethernet/IP.
  - b. Interface modules shall mount directly to VFC control board or be connected via Category 6 cables..
3. I/O shall be accessible through the serial communications adapter.
4. VFCs shall have the capability of allowing the overriding controller to monitor feedback.
5. A connection shall also be provided for personal computer interface.

## 2.4 LINE CONDITIONING AND FILTERING

- A. Input Line Conditioning: Provide an active line supply unit which controls the waveform of the input current and reduces the low order harmonic current drawn from the power line. The line currents and voltages shall be nearly sinusoidal.
- B. Output Filtering: Per manufacturer recommendation.
- C. EMI/RFI Filtering: All drives shall comply with applicable FCC Part 15 RF emission requirements.

## 2.5 BYPASS SYSTEMS

- A. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor, and retransfer shall only be allowed with the motor at zero speed.
- B. Bypass Contactors: Bypass shall include two contactors. The bypass contactor shall be used to connect the motor directly to the incoming power line in the event that the drive is out of service. The output contactor shall be used to isolate the VFC's output from input power and the motor when the motor is operating in the bypass mode. The output contactor and the bypass contactor shall be electrically interlocked to prevent simultaneous operation.
- C. Bypass Protection: Motor overload protection for the bypass mode shall be provided by a motor overload relay connected in both the drive and bypass modes of operation.
- D. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller
  1. Bypass Contactor: Load-break, NEMA-rated contactor.
  2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.
- E. Bypass Contactor Configuration: Full-voltage (across-the-line) type.
  1. NORMAL/BYPASS selector switch.
  2. HAND/OFF/AUTO selector switch.
  3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
  4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

- a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
  - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
6. Overload Relays: NEMA ICS 2.
- a. Solid-State Overload Relays:
    - 1) Switch or dial selectable for motor-running overload protection.
    - 2) Sensors in each phase.
    - 3) Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
    - 5) Analog communication module.
  - b. NC isolated overload alarm contact.
  - c. External overload, reset push button.

## 2.6 ENCLOSURES

- A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
1. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12, gasketed.

## 2.7 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
1. Push Buttons: Unguarded.
  2. Pilot Lights: Push to test.
  3. Selector Switches: Rotary type.
  4. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- B. NC bypass contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.
- E. Supplemental Digital Meters:
  1. Elapsed-time meter.
  2. Kilowatt meter.
  3. Kilowatt-hour meter.
- F. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 12 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- G. Cooling Fan and Exhaust System: For NEMA 250, Type 12; UL 508 component recognized: Supply fan, with stainless-steel intake and exhaust grills and filters; 120 V ac; obtained from integral CPT.
- H. Spare control-wiring terminal blocks; wired.

## 2.8 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
  1. Test each VFC while connected to a motor that is comparable to that for which the VFC is rated.
  2. Verification of Performance: Rate VFCs according to operation of functions and features specified.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Floor-Mounting Controllers: Install VFCs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in control circuits if not factory installed.
- E. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

### 3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.

2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

### 3.4 IDENTIFICATION

- A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  2. Label each VFC with engraved nameplate.
  3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
  1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- C. Tests and Inspections:
  1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
  2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
  3. Test continuity of each circuit.
  4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
  5. Test each motor for proper phase rotation.
  6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. VFCs will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

### 3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.7 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
- D. Set the taps on reduced-voltage autotransformer controllers.
- E. Set field-adjustable pressure switches.

### 3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

### 3.9 DEMONSTRATION

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

END OF SECTION 262923



**STRUCTURAL GENERAL NOTES:**

**A. DESIGN CODES AND SPECIFICATIONS:**

- CONNECTICUT STATE BUILDING CODE - 2003 IBC W/ 2005, 2009 AMENDMENTS
- AMERICAN CONCRETE INSTITUTE (ACI) 318-02
- AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC), ASD 1989, 335-89s
- AMERICAN SOCIETY OF CIVIL ENGINEERS, (ASCE) 7-02.

**B. GENERAL NOTES:**

- THE CONTRACTOR SHALL COORDINATE THE SIZE AND LOCATION OF ALL OPENINGS THROUGH ROOFS, FLOORS AND WALLS. VERIFY WITH THE OWNERS REPRESENTATIVE, ENGINEER AND VARIOUS TRADES AS REQUIRED. OPENINGS NOT SO VERIFIED SHALL BE MODIFIED, IF REQUIRED, AT NO ADDITIONAL COST.
- CONSTRUCTION METHODS, MEANS, TECHNIQUES, SEQUENCES, PROCEDURES AND SAFETY ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

**C. SHOP DRAWINGS:**

- SUBMIT SHOP DRAWINGS ON ALL MATERIALS FOR REVIEW BEFORE FABRICATION. THE CONTRACT DRAWINGS SHALL NOT BE USED AS BASE DRAWINGS FOR SHOP DRAWINGS. SHOP DRAWINGS SUBMITTED FOR REVIEW WHICH WERE PREPARED WITH CONTRACT DRAWINGS USED AS BASE DRAWINGS WILL BE REJECTED.
- ALL SUBMITTALS TO CONSULTANT FOR REVIEW SHALL BE PREVIOUSLY REVIEWED BY THE CONTRACTOR, WITH HIS APPROVAL STAMPED ON THE DRAWINGS, DATED AND SIGNED. SUBMITTALS NOT CONFORMING SHALL BE SUFFICIENT REASON FOR REJECTION BY THE ENGINEER.

**D. DESIGN LOADS**

- THE STRUCTURE WAS DESIGNED FOR THE MINIMUM LIVE LOADS SHOWN BELOW AND DEAD LOADS AS REQUIRED BY CONSTRUCTION MATERIALS
- ALL LOADS SHOWN BELOW ARE IN POUNDS PER SQUARE FOOT (U.N.O.)
  - EQUIPMENT DEAD LOADS:**
  - REFRIGERANT TANK: 10,800 LBS.(FLOODED W/ REFRIGERANT)
  - COOLING TOWER: 50,770 LBS.(MAX. OPER.)
  - CHILLER: 109,685 LBS.(OPER. WT.)
  - LIVE LOADS:**
  - PLATFORMS & STAIRS: 100 psf
  - WIND LOADS:**
  - BASIC WIND SPEED, V: 100 mph
  - EXPOSURE CATEGORY: B
  - SNOW LOADS:**
  - GROUND SNOW LOAD, Pg: 35 psf
  - SEISMIC LOADS:**
  - OCCUPANCY CATEGORY: II
  - IMPORTANCE FACTOR, Is: 1.0
  - SITE CLASS: D
  - Ss: 0.231
  - S1: 0.062
  - Sds: 0.246
  - Sd1: 0.099
  - SEISMIC DESIGN CATEGORY: B
- PROVIDE ALL GUYS, BRACES, STRUTS, ETC. REQUIRED TO ACCOMMODATE ALL LIVE AND DEAD LOADS ENCOUNTERED DURING THE CONSTRUCTION PROCESS.

**F. REINFORCING STEEL:**

- REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60.
- WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185. DEFORMED WELDED WIRE FABRIC SHALL CONFORM TO ASTM A497.
- BAR SUPPORTS, DESIGN, DETAILING, FABRICATION AND PLACING OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE CODE AND DETAILING MANUAL, LATEST EDITION. SUPPORT ALL REINFORCING ON METAL CHAIRS OR BOLSTERS.

**F. CONCRETE:**

- UNLESS OTHERWISE INDICATED ON DRAWINGS, PROVIDE MINIMUM CONCRETE COVER FOR ALL REINFORCING IN ACCORDANCE WITH ACI 318-02.
- ALL CONCRETE SHALL BE NORMAL WEIGHT (N.W.) WITH A MAXIMUM UNIT WEIGHT OF 150 POUNDS PER CUBIC FOOT AND SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
- MIX DESIGNS SHALL BE SUBMITTED FOR APPROVAL IN CONFORMANCE WITH ACI 301-99. SUBMITTALS NOT CONFORMING WILL BE REJECTED. PLACE CONCRETE ONLY WITH APPROVED MIX DESIGN. MAXIMUM WATER/CEMENT RATIO - 0.45.
- ALL CONCRETE WORK SHALL CONFORM TO THE REQUIREMENTS OF ACI 301-99, SPECIFICATIONS FOR STRUCTURAL CONCRETE BUILDINGS, UNLESS OTHERWISE NOTED ON THE CONTRACT DRAWINGS OR IN THE SPECIFICATIONS. COORDINATE CONCRETE WORK WITH OTHER TRADES BEFORE BEGINNING WORK. VIBRATE ALL CONCRETE PLACED IN FOOTING EXCAVATIONS. THE GENERAL CONTRACTOR SHALL COORDINATE WITH THE OWNER AND ENGINEER ANY REQUIREMENTS BY THE OWNER, OR VARIOUS TRADES FOR TRENCHES, PITS, INSERT ITEMS, OPENINGS, ETC. WHICH MAY BE REQUIRED IN THE FLOOR SLABS OR WALLS BEFORE PLACING CONCRETE.

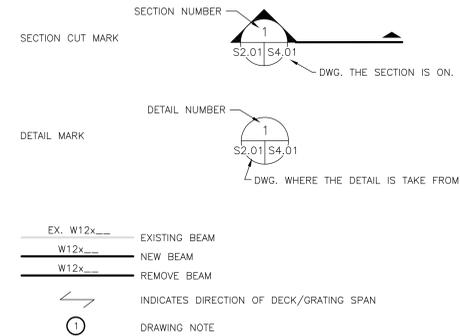
**G. STRUCTURAL STEEL:**

- FABRICATE AND ERECT STRUCTURAL STEEL IN ACCORDANCE WITH AISC MANUAL OF STEEL CONSTRUCTION, 9TH ED AND AISC'S "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES."
- STRUCTURAL STEEL SHALL CONFORM TO ASTM A992, GRADE 50. STRUCTURAL TUBE SHALL CONFORM TO ASTM A500, GRADE B (Fy=46ksi). STRUCTURAL PIPE SHALL CONFORM TO ASTM A53, TYPE E OR S, GRADE B. STRUCTURAL PLATE AND ANGLES SHALL CONFORM TO ASTM A36.
- THE STRUCTURAL STEEL SHALL BE FABRICATED IN A PLANT CERTIFIED BY THE AISC AS CATEGORY "CONVENTIONAL STEEL STRUCTURES", OR THE STRUCTURAL STEEL FABRICATOR MUST DEMONSTRATE A CONSISTENT RECORD OF AT LEAST 10 (TEN) SUCCESSFUL PROJECTS OF EQUAL OR GREATER MAGNITUDE OVER THE PRECEDING 2 YEARS. THE CONTRACTOR SHALL SUBMIT EVIDENCE IN WRITING VERIFYING ONE OF THE ABOVE REQUIRED QUALIFICATIONS.
- THE STRUCTURAL STEEL SHALL BE ERECTED BY AN AISC CERTIFIED STEEL ERECTOR, OR THE ERECTOR MUST DEMONSTRATE A CONSISTENT RECORD OF AT LEAST 10(TEN) SUCCESSFUL PROJECTS OF EQUAL OR GREATER MAGNITUDE OVER THE PRECEDING TWO YEARS. SUBMIT EVIDENCE OF CERTIFICATION.
- BOLTED CONNECTIONS - USE 3/4 INCH DIAMETER ASTM A325-N BOLTS MINIMUM.
- BOLTED CONNECTIONS SHALL BE DESIGNED, FABRICATED AND INSTALLED IN ACCORDANCE WITH AISC SPECIFICATIONS FOR "STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS." ALTERNATE DESIGN BOLTS OR DIRECT TENSION INDICATOR DEVICES WILL BE ACCEPTED ONLY BY WRITTEN APPROVAL OF THE ENGINEER. INSTALLATION SHALL BE IN ACCORDANCE WITH SECTION 8 OF THE SPECIFICATION.
- ALL SHOP AND FIELD WELDING SHALL BE BY CERTIFIED WELDERS AND SHALL CONFORM TO AWS STANDARDS. WELDERS SHALL HAVE A CURRENT CERTIFICATION WITHIN THREE YEARS OF THE DATE OF PROJECT COMMENCEMENT. CURRENT AWS CERTIFICATIONS SHALL BE AVAILABLE AT THE JOB SITE FOR REVIEW BY THE ENGINEER OR INSPECTOR. NO FIELD CUTTING OF STRUCTURAL STEEL MEMBERS BY ANY TRADE WILL BE ALLOWED WITHOUT PRIOR APPROVAL OF THE STRUCTURAL ENGINEER.
- USE E70XX ELECTRODES UNLESS NOTED OTHERWISE.
- ALL STRUCTURAL STEEL SHALL RECEIVE A STANDARD SHOP PRIMER PAINT, EXCEPT AT WELDING LOCATIONS. PAINT ALL STEEL AS PER SPECIFICATIONS.
- EQUIPMENT ANCHOR BOLTS/RODS SHALL CONFORM TO ASTM F1554 GRADE 36 UNLESS NOTED OTHERWISE. ANCHOR RODS AND EXPANSION ANCHORS FOR STRUCTURAL STEEL CONNECTIONS SHALL BE ASTM F1554 GRADE 36 UNLESS NOTED OTHERWISE.
- EPOXY ADHESIVE SYSTEM SHALL BE HIT HY 150 BY HILTI CORP., POWER FAST BY POWERS FASTENERS OR ACCEPTABLE EQUAL.
- SUBMIT SHOP DRAWINGS OF CHILLER ACCESS PLATFORMS FOR ENGINEER REVIEW AND APPROVAL. REFER TO SPECIFICATION SECTION 05500 FOR STEEL GRATING, LADDERS AND GUARDRAILS.

**H. GRATING:**

- GRATING SHALL BE HEAVY DUTY WELDED BAR GRATING. BEARING BARS SHALL BE 1-1/2" DEEP SPACED AT 1-3/16" ON CENTER WITH CROSS BARS AT 4" ON CENTER. GRATING SHALL RECEIVE A BLACK PAINTED FINISH. FASTEN GRATING TO SUPPORTS WITH MANUFACTURER'S STANDARD SADDLE CLIPS AND SCREWS. PROVIDE A MINIMUM OF TWO SADDLE CLIP FASTENERS AT PANEL ENDS AND AT INTERMEDIATE SUPPORTS.

**STRUCTURAL LEGEND**



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



**RMF ENGINEERING, INC.**  
5520 RESEARCH PARK DR., 3rd FLR  
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REVISIONS:

MARK	DATE	DESCRIPTION

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PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

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AUTHOR: wwm

DRAFTER: jkr

SCALE: AS NOTED

PRINT DATE: 05-01-2014

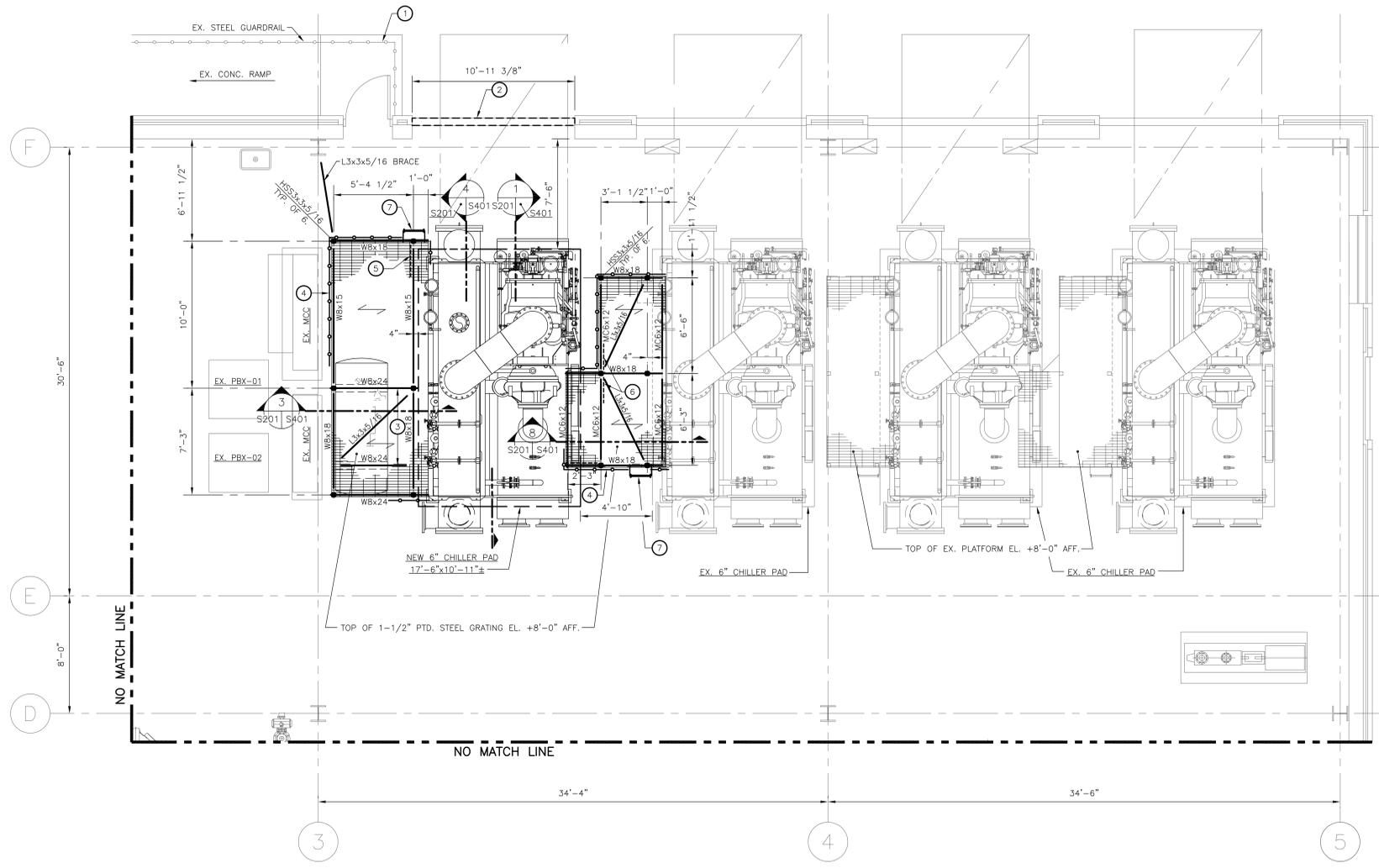
SHEET TITLE:

STRUCTURAL  
GENERAL  
NOTES

SHEET:

**S0.01**

SHEET: 02 of 61



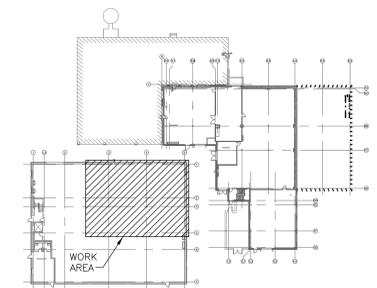
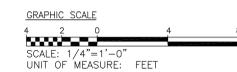
**FIRST FLOOR LOWER LEVEL**  
SCALE: 1/4"=1'-0"

**GENERAL NOTES:**

- TOP OF EX. 8" AT-GRADE FLOOR SLAB ELEVATION = 592'-6". SLAB REINFORCED WITH 6x6 W4.0xW4.0 WWF ON 10 MIL VAPOR BARRIER ON 12" COMPACTED STRUCTURAL FILL.

**DRAWING NOTES:**

- REMOVE EMBEDDED STEEL RAILING FROM CONCRETE RAMP IF NEEDED FOR CHILLER INSTALLATION. REINSTALL RAILING MATCHING EXISTING CONSTRUCTION.
- REMOVE AND REINSTALL METAL WALL PANEL INFILL SYSTEM AFTER INSTALLATION OF EQUIPMENT. TEMPORARILY STORE WALL COMPONENTS WHERE THEY WILL NOT BE DAMAGED IN A LOCATION ACCEPTABLE TO UNIVERSITY. REPLACE ANY DAMAGED MATERIALS WITH NEW, MATCHING EXISTING CONSTRUCTION. SEE DETAIL OF ORIGINAL WALL PANEL CONSTRUCTION, 5/54.01.
- FIELD MEASURE EX. TANK SUPPORT ANCHOR HOLE LOCATIONS AND SPACE NEW TANK SUPPORT BEAMS ACCORDINGLY. TANK SUPPORT SHALL BE CENTERED ON SUPPORT BEAMS.
- PROVIDE GUARDRAIL AROUND PLATFORM PERIMETERS WHERE INDICATED AND WHERE FIELD CONDITIONS REQUIRE FALL PROTECTION. GUARDRAIL SHALL BE 1-1/2" STEEL PIPE. GUARDRAIL CONNECTIONS TO STEEL BEAMS SHALL BE BOLTED FOR REMOVAL. SEE DETAILS ON S4.01.
- PROVIDE L3x3x5/16 45° KNEE BRACE. SEE DETAIL 4/54.01.
- PROVIDE L2.5x2.5x5/16 45° KNEE BRACE. SEE DETAIL 8/54.01.
- PROVIDE 16" WIDE STEEL LADDER WITH 3/4" DIAMETER RUNGS WITH NON-SLIP SURFACE. SEE DETAIL 6/54.01.



**KEY PLAN**  
SCALE: NONE

CERTIFICATION:

STATUS:

**BID SET**

CONSULTANT:



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H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\S201

AUTHOR: wwm

DRAFTER: jkr

SCALE: AS NOTED

PRINT DATE: 05-01-2014

SHEET TITLE:

FIRST FLOOR  
LOWER LEVEL PART  
PLAN - NEW WORK

SHEET:

**S2.01**

SHEET: 03 of 61









## MECHANICAL ABBREVIATIONS

AAV AUTOMATIC AIR VENT	LAT LEAVING AIR TEMPERATURE	LPR LOW PRESSURE CONDENSATE RETURN
AC AIR CONDITIONING	LPS LOW PRESSURE STEAM SUPPLY	L.W.T. LEAVING WATER TEMPERATURE
A.D. ACCESS DOOR	MAV MANUAL AIR VENT	MAX. MAXIMUM
AFT ABOVE FINISHED FLOOR	MBH 1000 BTUH	MCC MOTOR CONTROL CENTER
ATC AUTOMATIC TEMPERATURE CONTROLS	MECH MECHANICAL	MIN. MINIMUM
BD BLOWDOWN	MOD MOTOR OPERATED DAMPER	MPS MEDIUM PRESSURE CONDENSATE RETURN
BF BLIND FLANGE	MPS MEDIUM PRESSURE STEAM	NO. NUMBER
BFW BOILER FEEDWATER	NPW NON-POTABLE WATER	NPT NOMINAL PIPE THREAD
BHP BRAKE HORSEPOWER	OA OUTSIDE AIR	PC PUMPED CONDENSATE
BLOG. BRITISH THERMAL UNITS PER HOUR	PG PRESSURE GAGE	PI PRESSURE INDICATION
CB CONTINUOUS BLOWDOWN	PP PRIMARY PUMPS	PPH POUNDS PER HOUR
CDP CONDENSER WATER PUMP	PRESS. PRESSURE	PRV PRESSURE REGULATING VALVE
CF CHEMICAL FEED	PRV PRESSURE REGULATING VALVE	PR PRESSURE RELIEF
CFM CUBIC FEET PER MINUTE	PSIA POUNDS PER SQUARE INCH ABSOLUTE	PSIG POUNDS PER SQUARE INCH GAUGE
CH CHILLER	PT PRESSURE TRANSMITTER	RA RETURN AIR
CHW CHILLED WATER	RA RETURN AIR	REL RELOCATE EXISTING
CHP CHILLED WATER PUMP	REC. RECEIVER	REC. RECEIVER
CHWR CHILLED WATER RETURN	R.D.R. ROOF DRAIN	RECIRC. RECIRCULATION
CHWS CHILLED WATER SUPPLY	REF REFRIGERANT EXHAUST FAN	REFRIG. REFRIGERANT
CLGTWR COOLING TOWER	RL RAIN LEADER	RM ROOM
CO CLEANOUT	RM ROOM	RPM REVOLUTIONS PER MINUTE
CONC. CONCRETE	RV RELIEF VALVE	RV RELIEF VALVE
CR CONDENSER WATER RETURN	RX REMOVE EXISTING	SA SUPPLY AIR
CS CONDENSER WATER SUPPLY	SA SANITARY	SCHED. SCHEDULE
CV CONTROL VALVE	SP STATIC PRESSURE	SPR SPRINKLER PIPE
CW CITY WATER	SPR SPRINKLER PIPE	SQ. SQUARE
dB DECIBELS	SS STAINLESS STEEL	SS STAINLESS STEEL
DIA DIAMETER	STP STEAM TRAP	STP STEAM UNIT HEATER
DISCH. DISCHARGE	STU STEAM UNIT HEATER	SV STEAM VENT
DN DOWN	SV STEAM VENT	SW STORM WATER
DOM. DOMESTIC	TEMP. TEMPERATURE	TEMP. TEMPERATURE
DP DIFFERENTIAL PRESSURE	TG TEMPERATURE GAGE	TI TEMPERATURE INDICATION
DR. DRAWINGS	TT TEMPERATURE TRANSMITTER	TOS TOP OF STEEL
EA EXHAUST AIR	TSU THERMAL STORAGE UNIT	TT TEMPERATURE TRANSMITTER
EAT ENTERING AIR TEMPERATURE	TYP. TYPICAL	UH UNIT HEATER
EF EXHAUST FAN	UH UNIT HEATER	V VENT
EF EXHAUST GRILLE	VR VACUUM RELIEF	VR VACUUM RELIEF
EFF EFFICIENCY	VTR VENT TO ATMOSPHERE	VTR VENT THRU ROOF
ELEV ELEVATION	W WIDE, WIDTH	W/ WITH
E.W.T. ENTERING WATER TEMPERATURE	W.C. WATER CLOSET	W.G. WATER GAUGE
EXH EXHAUST	W.G. WATER GAUGE	
EX EXISTING		
FD, F.D.R. FLOOR DRAIN		
F.F. FINISHED FLOOR		
F.F. FLOOR		
FM FLOW METER		
FT FIRE PROTECTION		
FT FOOT, FEET		
FUT FUTURE		
GA. GAUGE		
GA. GALLON		
GLY GLYCOL		
GLYXT GLYCOL EXPANSION TANK		
GPM GALLON PER MINUTE		
GR GYCOL RETURN		
GRD. GROUND		
GS GLYCOL SUPPLY		
HB HOSE BIB		
HP HORSEPOWER		
HPS HIGH PRESSURE STEAM		
HPR HIGH PRESSURE CONDENSATE RETURN		
HW HOT WATER		
IA INSTRUMENT AIR		
IN. INCHES		
INST. INSTRUMENT		
KW KILOWATT		

## INSTRUMENT DESCRIPTION TABLE

FIRST LETTER		SUCCEEDING LETTER		
MEASURED OR INITIATED VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS	ALARM	ALARM/AUTOMATIC	
B	BURNER FLAME	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY		CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL		
E	VOLTAGE (EMF)	PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)		
G	GAUGING (DIMENSIONAL)	GLASS		
H	HAND (MANUALLY INITIATED)			HIGH
I	CURRENT (ELECTRICAL)	INDICATE		
J	POWER	SCAN		
K	TIME OR TIME SCHEDULE		CONTROL STATION	
L	LEVEL	LIGHT (PILOT)		LOW
M	MOISTURE HUMIDITY			MIDDLE OR INTERMEDIATE
N	CONSISTENCY	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE	ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM	POINT (TEST) CONNECTION		
Q	QUALITY OR EVENT	INTEGRATE OR TOTALIZE		
R	RADIOACTIVITY	RECORD OR PRINT		
S	SPEED OR SOLENOID FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE	MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY OR VIBRATION		VALVE, DAMPER OR LOUVER	
W	WEIGHT OR FORCE	WELL		
X	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	
Y	USER'S CHOICE		RELAY OR COMPUTE	
Z	POSITION		DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

## MECHANICAL LEGEND

SYMBOL	ABBREV.	DESCRIPTION
	--	CONNECT TO EXISTING (NEW WORK DRAWINGS)
	--	POINT OF DISCONNECT (DEMOLITION DRAWINGS)
	--	EXISTING PIPING
	--	REMOVE EXISTING PIPING (SHOWN SOLID & BOLD ON DEMO. DWGS.)
	--	NEW PIPING (SHOWN SOLID & BOLD ON NEW WORK DWGS.)
	--	RELOCATE EXISTING (SHOWN SOLID & BOLD ON DEMO. & NEW WORK DWGS.)
	--	GATE VALVE, SHUT-OFF VALVE
	--	OUTSIDE STEM & YOKE (OS&Y) GATE VALVE
	--	AUTOMATIC CONTROL VALVE
	--	SOLENOID ACTUATED VALVE
	--	BUTTERFLY VALVE
	--	ACTUATED BUTTERFLY CONTROL VALVE
	--	GLOBE VALVE
	--	GLOBE VALVE (NORMALLY CLOSED)
	--	Y-PATTERN GLOBE VALVE
	--	BALL VALVE
	--	BALL VALVE (NORMALLY CLOSED)
	--	PRESSURE REGULATING VALVE
	--	RIGHT ANGLE VALVE
	--	PRESSURE RELIEF VALVE
	--	TRYCOCKS
	--	CHECK VALVE
	--	BACKFLOW PREVENTOR
	--	PLUG VALVE
	--	STRAINER
	--	STRAINER WITH BLOW OFF
	--	CONCENTRIC REDUCER
	--	ECCENTRIC REDUCER
	--	PRESSURE GAUGE WITH SNUBBERS
	--	PRESSURE GAUGE WITH ANTI SIPHON
	--	TEMPERATURE GAUGE
	--	FLANGES
	--	PIPE DROPS
	--	PIPE RISERS
	--	FLOW DIRECTION
	--	PIPE CAP
	--	PIPE BREAK
	--	VENT THRU ROOF
	--	PUMP
	--	FLEXIBLE CONNECTOR
	--	PIPE UNION
	--	STEAM TRAP STATION
	--	COLUMN LINE DESIGNATION
	--	SENSOR/TRANSMITTER (XX DEFINES TYPE)
	--	AIR FLOW
	--	ELECTRONIC INSTRUMENT SIGNAL
	--	PNEUMATIC SIGNAL LINE
	F.D.R., FD	OPEN DRAIN, FLOOR DRAIN
	F.D.R., FD	FLOOR/ROOF DRAIN
	--	DI-ELECTRIC CONNECTOR/FITTING
	--	FLOW METER
	--	FLOW METER
	PSD	PUMP SUCTION DIFFUSER
	--	ELECTRIC MOTOR
	--	HOSE END CONNECTION
	--	TEE STRAINER
	--	SPEC DESIGNATION CHANGE

## MECHANICAL LEGEND - PIPING - DOUBLE LINE

SYMBOL	ABBREV.	DESCRIPTION
	BV	BUTTERFLY VALVE
	--	BUTTERFLY VALVE WITH GEAR OPERATOR
	--	BUTTERFLY VALVE WITH ELECTRIC ACTUATOR
	--	GATE VALVE
	--	WELD NECK FLANGES
	--	WELD NECK BLIND FLANGE
	--	FLOW ELEMENT
	--	BASKET STRAINER
	--	Y-STRAINER
	--	CHECK VALVE
	--	VENTURI FLOW METER
	--	PLUG VALVE
	--	PRESSURE RELIEF VALVE
	--	NORTH ARROW

## CONTROL INSTRUMENTATION LEGEND

SYMBOL	DESCRIPTION
	FUNCTIONAL INSTRUMENT DESCRIPTION (SEE INSTRUMENT DESCRIPTION TABLE)
	INSTRUMENT NUMBER
	INSTRUMENT SYMBOL - FIELD MOUNTED
	INSTRUMENT SYMBOL - PANEL MOUNTED
	SHARED INSTRUMENT DISPLAY/CONTROL - PANEL MOUNTED
	INSTRUMENT FUNCTION - PLANT CONTROL SYSTEM
	PROGRAMMABLE LOGIC CONTROL - PANEL MOUNTED
	EQUIPMENT INTERLOCK
TAG LABEL CONVENTION	
xxx	SYSTEM DESIGNATION
yyy	EQUIPMENT DESIGNATION
-z	SEQUENTIAL IDENTIFIER

### GENERAL NOTES:

- NOTIFY THE UNIVERSITY OF CONNECTICUT IN WRITING AT LEAST FOURTEEN (14) DAYS IN ADVANCE OF ALL REQUIRED SHUTDOWNS OF WATER, ELECTRICAL SERVICE, OR OTHER UTILITIES FOLLOWED WITH 72 HOUR NOTICE OF SHUTDOWN TO THE UNIVERSITY. UPON WRITTEN RECEIPT OF APPROVAL FROM THE UNIVERSITY OF CONNECTICUT, SHUTDOWNS SHALL BE PERFORMED BETWEEN THE HOURS OF SIX (6) P.M. AND SIX (6) A.M. OR AS DIRECTED OTHERWISE BY THE UNIVERSITY AND SHALL BE ACCOMPLISHED AT NO ADDITIONAL CONTRACT COST. AT THE END OF EACH SHUTDOWN ALL SERVICES SHALL BE RESTORED SO THAT NORMAL USE OF THE UTILITIES CAN CONTINUE.
- WHEN WORKING IN AND AROUND THE EXISTING BUILDING, EXTREME CARE SHALL BE EXERCISED WITH REGARD TO PROTECTION OF THE EXISTING STRUCTURES AND MECHANICAL AND ELECTRICAL SERVICES WHICH WILL REMAIN. REPAIR, REPLACE, OR RESTORE TO THE SATISFACTION OF THE UNIVERSITY CONSTRUCTION MANAGER ALL EXISTING WORK DAMAGED IN THE PERFORMANCE OF DEMOLITION AND/OR NEW WORK.
- ALL EXISTING MATERIALS AND EQUIPMENT WHICH ARE REMOVED AND ARE DESIRED BY THE UNIVERSITY, OR ARE INDICATED TO REMAIN THE PROPERTY OF THE UNIVERSITY, SHALL BE TURNED OVER TO THE UNIVERSITY AT THE JOBSITE. ALL OTHER MATERIALS AND EQUIPMENT WHICH ARE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED BY THE CONTRACTOR FROM THE PREMISES.
- EXISTING CONDITIONS, I.E., PRESENCE AND LOCATION OF PIPING, EQUIPMENT, AND MATERIALS, INDICATED ARE BASED ON INFORMATION OBTAINED FROM AVAILABLE RECORD DRAWINGS AND FIELD SURVEYS AND ARE NOT WARRANTED TO BE COMPLETE OR CORRECT. CONTRACTOR SHALL FIELD VERIFY EXACT LOCATION OF ALL PIPING, EQUIPMENT, AND MATERIALS IN THE FIELD PRIOR TO STARTING ALL WORK.
- EXISTING PIPE, AND EQUIPMENT SIZES NOTED ARE FOR THE CONVENIENCE OF THE CONTRACTOR ONLY AND ARE NOT WARRANTED TO BE CORRECT. CONTRACTOR SHALL VERIFY ALL SIZES IN THE FIELD IF THEY AFFECT HIS WORK.
- EXISTING PIPING NO LONGER REQUIRED TO REMAIN IN SERVICE (SHOWN OR OTHERWISE) SHALL BE DISCONNECTED AND REMOVED BACK TO SERVICE MAINS UNLESS OTHERWISE INDICATED OR NOTED ON THE PLANS. REMOVE EXISTING PIPE HANGERS, SUPPORTS, VALVES, ETC. EXISTING PIPING INDICATED OR REQUIRED TO REMAIN IN SERVICE OR IN PLACE SHALL BE CAPPED, PLUGGED, OR OTHERWISE SEALED. NO EXISTING ABANDONED PIPING SHALL BE LEFT OPEN ENDED.
- EXISTING MECHANICAL AND ELECTRICAL EQUIPMENT, PIPING, AND MATERIALS AFFECTED BY DEMOLITION OR NEW WORK SHALL BE INSTALLED AND REQUIRED TO REMAIN IN SERVICE SHALL BE REINSTALLED OR SUPPORTED AS REQUIRED IN ACCORDANCE WITH NEW WORK SPECIFICATION. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE UNIVERSITY CONSTRUCTION MANAGER AND AT NO ADDITIONAL CONTRACT COST.
- ALL NEW AND EXISTING OPENINGS AND WALLS, CEILINGS, ROOF, AND FLOOR SURFACES DAMAGED OR CREATED BY DEMOLITION WORK SHALL BE PATCHED TO MATCH EXISTING IN ALL RESPECTS. PATCHING WHERE POSSIBLE SHALL MATCH EXISTING ADJACENT SURFACES AS TO THICKNESS, TEXTURES, MATERIALS, AND COLOR. ALL PATCHING SHALL BE PERFORMED TO THE SATISFACTION OF THE UNIVERSITY CONSTRUCTION MANAGER AND AT NO ADDITIONAL CONTRACT COST. ALL EXISTING INSULATION DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE UNIVERSITY CONSTRUCTION MANAGER.
- IN GENERAL ALL PIPING, EQUIPMENT, AND MATERIALS SHOWN "LIGHT" ARE EXISTING TO REMAIN. ALL PIPING, CONDUITS, EQUIPMENT, AND MATERIALS SHOWN "HEAVY AND SOLID" ON DEMOLITION DRAWINGS ARE EXISTING AND SHALL BE DEMOLISHED. ALL PIPING, CONDUITS, EQUIPMENT, AND MATERIALS SHOWN "HEAVY AND SOLID" ON NEW WORK DRAWINGS IS NEW AND SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR.
- CONTRACTOR SHALL REMOVE ALL ASSOCIATED ACCESSORIES, CONTROLS, ENCLOSURES, SUPPORTS, HANGERS, PADS, ETC. WITH ALL EQUIPMENT SHOWN TO BE DEMOLISHED. CONTRACTOR SHALL REPAIR AND PAINT ALL DAMAGED SURFACES AND ALL SURFACES BEHIND ALL EQUIPMENT SHOWN TO BE DEMOLISHED TO MATCH EXISTING ADJACENT SURFACES.
- CONTRACTOR SHALL BE RESPONSIBLE TO REMOVE ALL FLUIDS CONTAINED WITHIN ALL PIPING, EQUIPMENT AND TANKS. NO FLUIDS WILL BE ALLOWED TO BE DISCHARGED TO SANITARY OR STORM LINES WITHOUT WRITTEN APPROVAL FROM THE UNIVERSITY CONSTRUCTION MANAGER. CONTRACTOR SHALL BE RESPONSIBLE TO CONTAIN, HAUL, AND PROPERLY, AND LEGALLY DISPOSE OF ALL REMOVED FLUIDS OFFSITE.
- CONTRACTOR SHALL PROVIDE LOW POINT DRAINS AS REQUIRED TO COMPLETELY DRAIN ALL NEW WORK SYSTEMS, AND SHALL ALSO PROVIDE MANUAL AIR VENTS AT ALL SYSTEM HIGH POINTS.

### CERTIFICATION:

STATUS: **BID SET**

### CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

### REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES



### PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:  
H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M001

AUTHOR: wwm

DRAFTER: rjc

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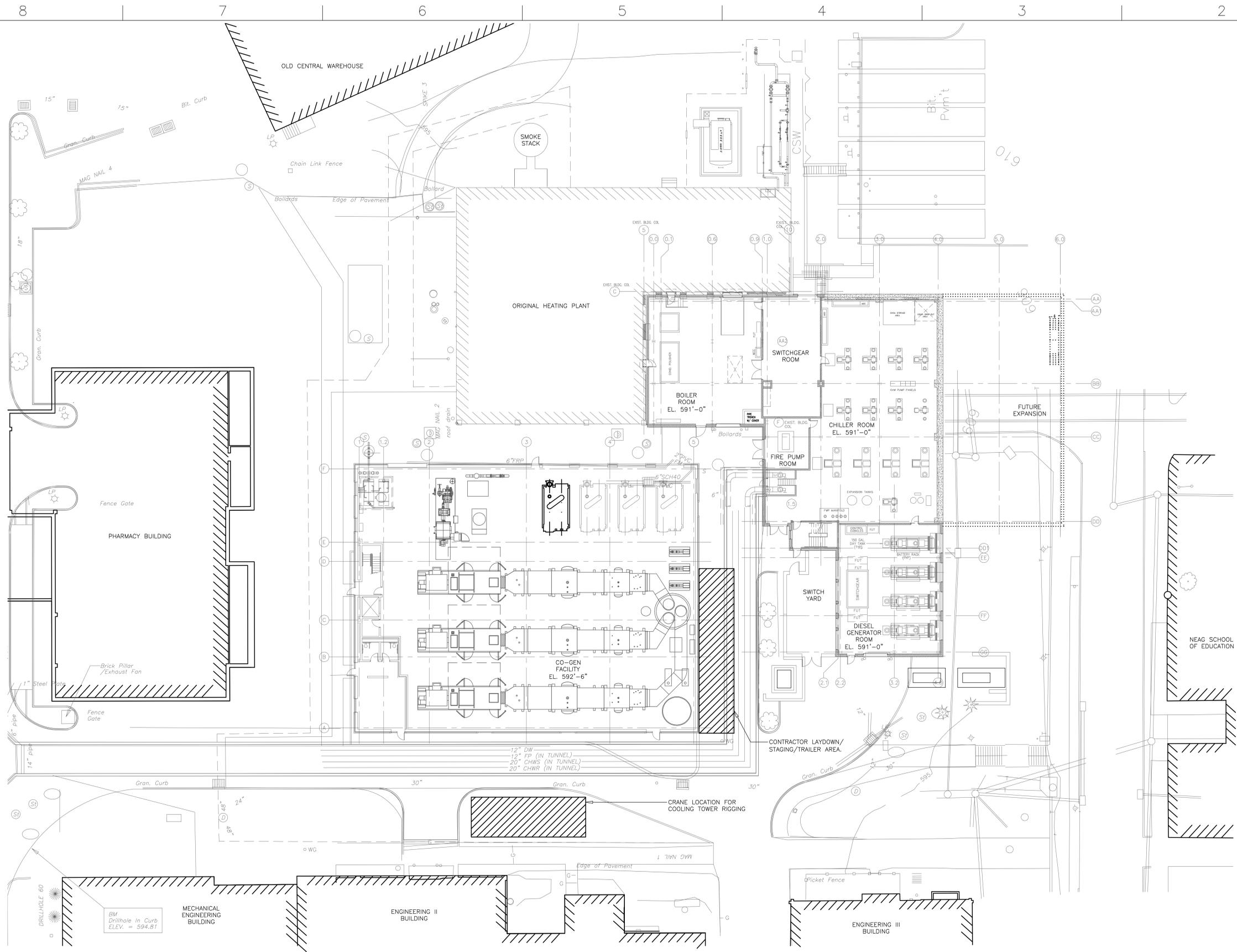
PRINT DATE: 05-01-2014

SHEET TITLE:  
**LEGEND AND ABBREVIATIONS**

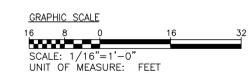
SHEET:

# M0.01

SHEET: 08 of 61



**SITE LOGISTICS AND PLAN**  
SCALE: 1/16"=1'-0"



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDOYT ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

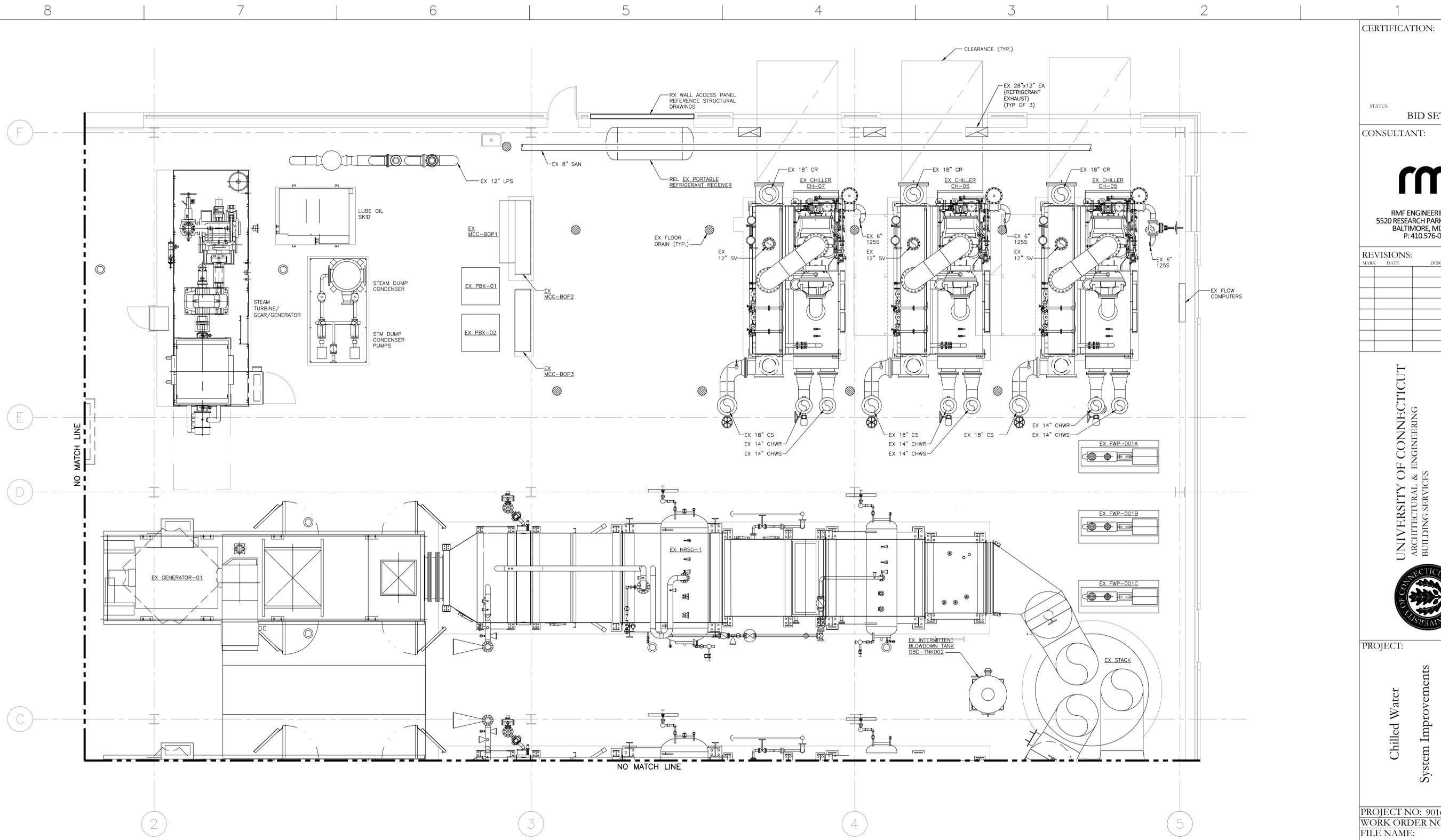
Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
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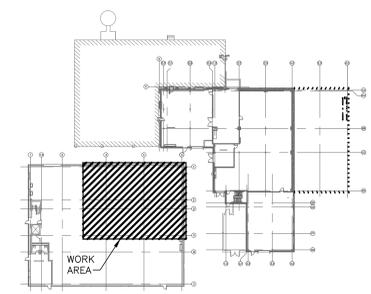
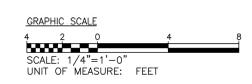
AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/16" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
SITE LOGISTICS AND PLAN

SHEET:  
**M0.02**

SHEET: 09 of 61



**FIRST FLOOR LOWER LEVEL**  
SCALE: 1/4"=1'-0"



**KEY PLAN**  
SCALE: NONE

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

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5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDDY ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

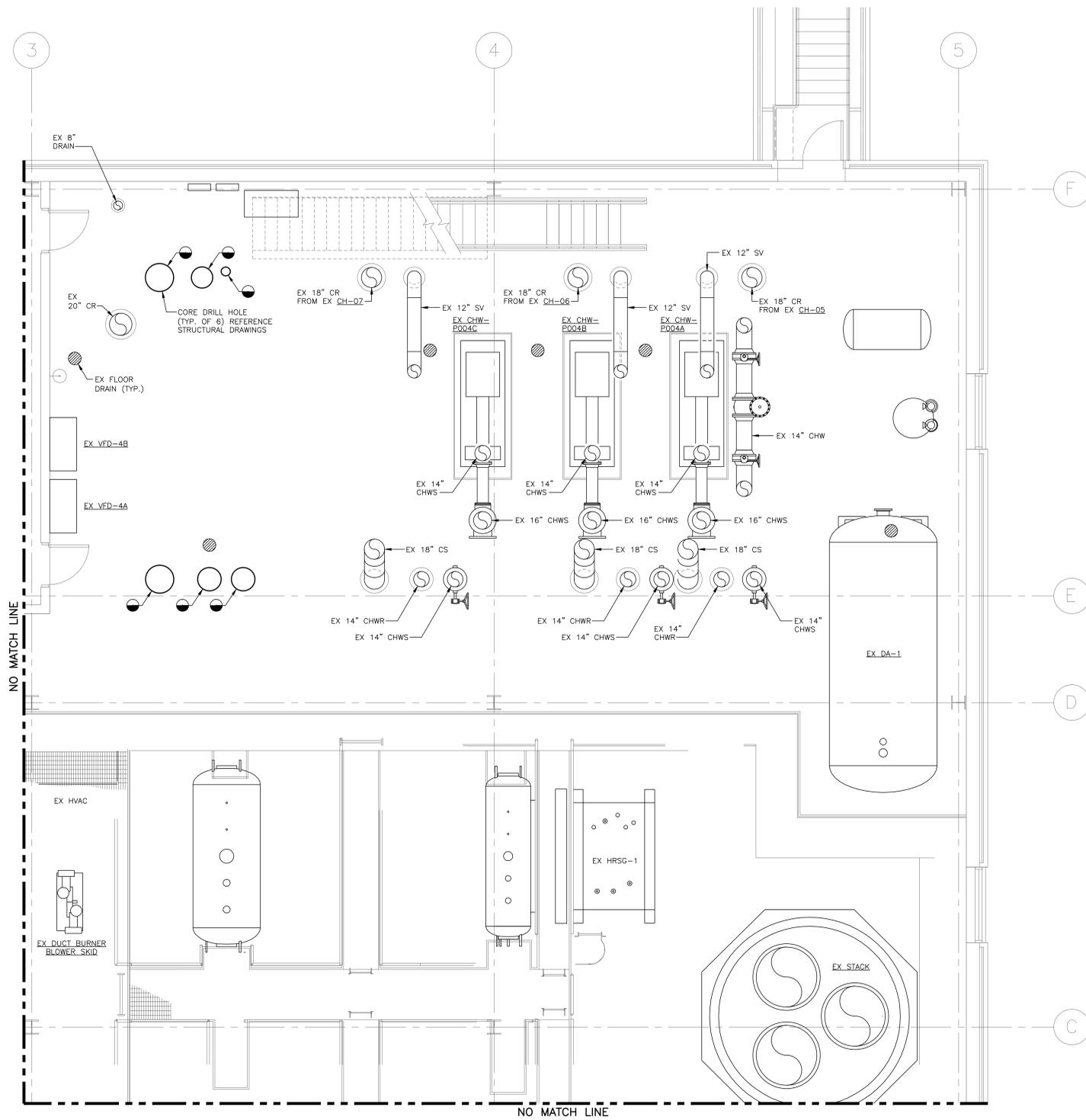
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WORK ORDER NO: #####  
FILE NAME:  
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AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/4"=1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
FIRST FLOOR  
LOWER LEVEL PART  
PLAN - DEMOLITION

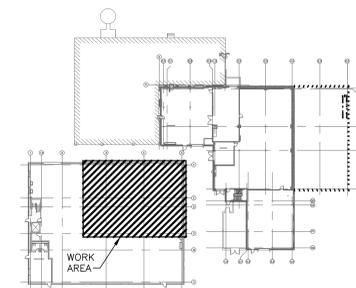
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**M1.01**

SHEET: 10 of 61

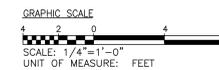




SECOND FLOOR LOWER LEVEL  
SCALE: 1/4"=1'-0"



KEY PLAN  
SCALE: NONE



GRAPHIC SCALE  
SCALE: 1/4"=1'-0"  
UNIT OF MEASURE: FEET

CERTIFICATION:

STATUS: BID SET

CONSULTANT:



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5520 RESEARCH PARK DR., 3RD FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

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BUILDING SERVICES

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STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M103

AUTHOR: WWM

DRAFTER: RJC

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

PRINT DATE: 05-01-2014

SHEET TITLE:

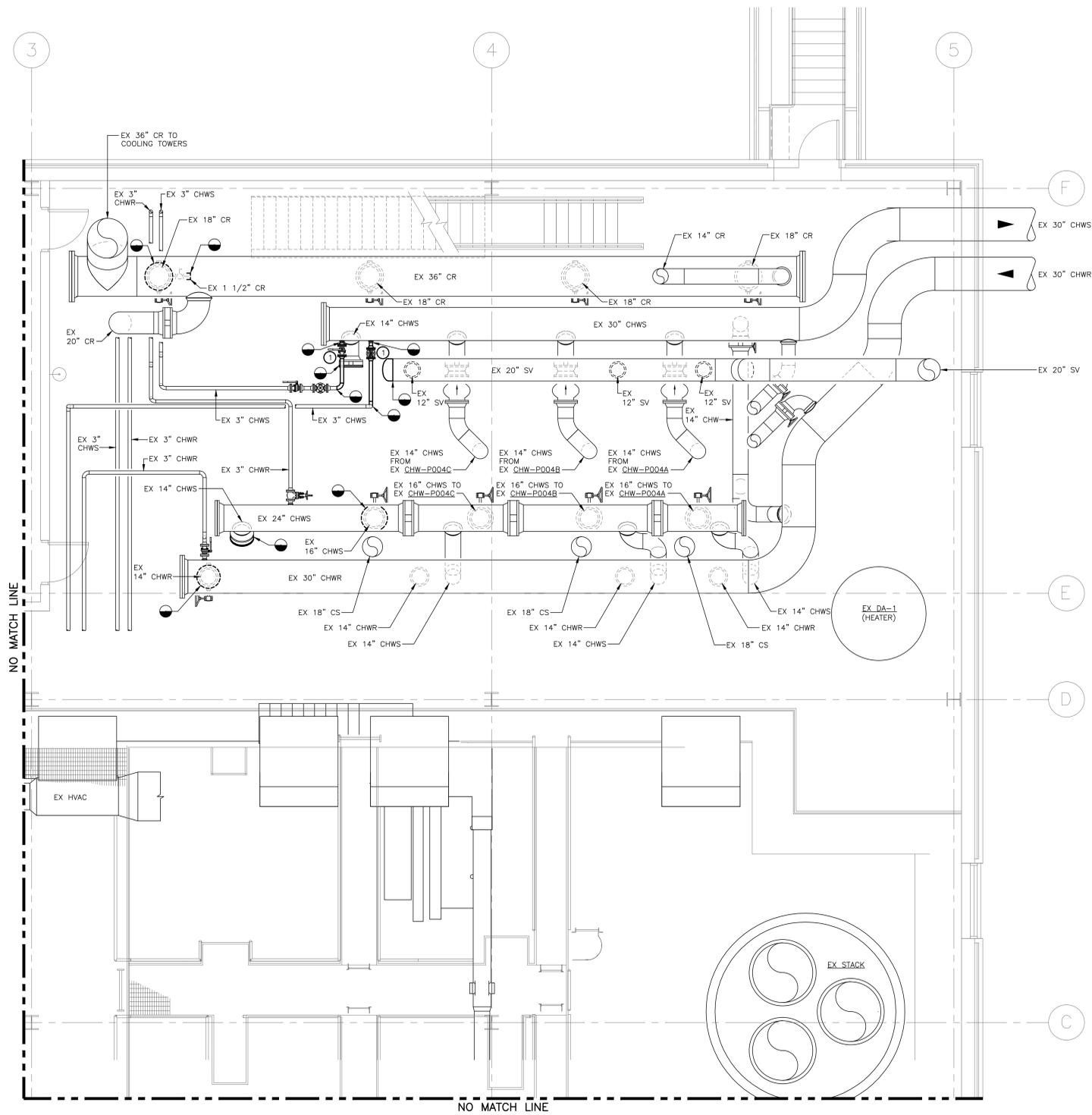
SECOND FLOOR  
LOWER LEVEL PART  
PLAN - DEMOLITION

SHEET:

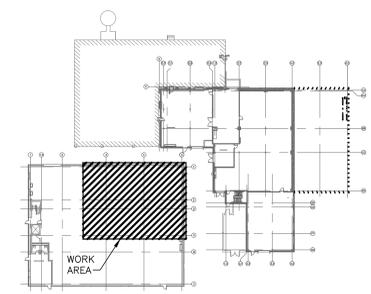
M1.03

SHEET: 12 of 61

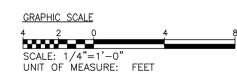
**DRAWING NOTES:**  
 ① RELOCATE EXISTING VALVES PER DRAWING M2.04.



**SECOND FLOOR UPPER LEVEL**  
 SCALE: 1/4"=1'-0"



**KEY PLAN**  
 SCALE: NONE



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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 FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M104

AUTHOR: wwm  
 DRAFTER: rjc  
 SCALE: 1/4"=1'-0"  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:

SECOND FLOOR  
 UPPER LEVEL PART  
 PLAN - DEMOLITION

SHEET:

**M1.04**

SHEET: 13 of 61

**DRAWING NOTES:**

① CHEMICAL TANKS AND SUPPORT RELOCATION SHALL BE COORDINATED WITH THE UNIVERSITY.

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**



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P: 410.576-0505

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FACSIMILE: (860) 486-3177



**PROJECT:**

Chilled Water  
System Improvements  
Central Utility Plant

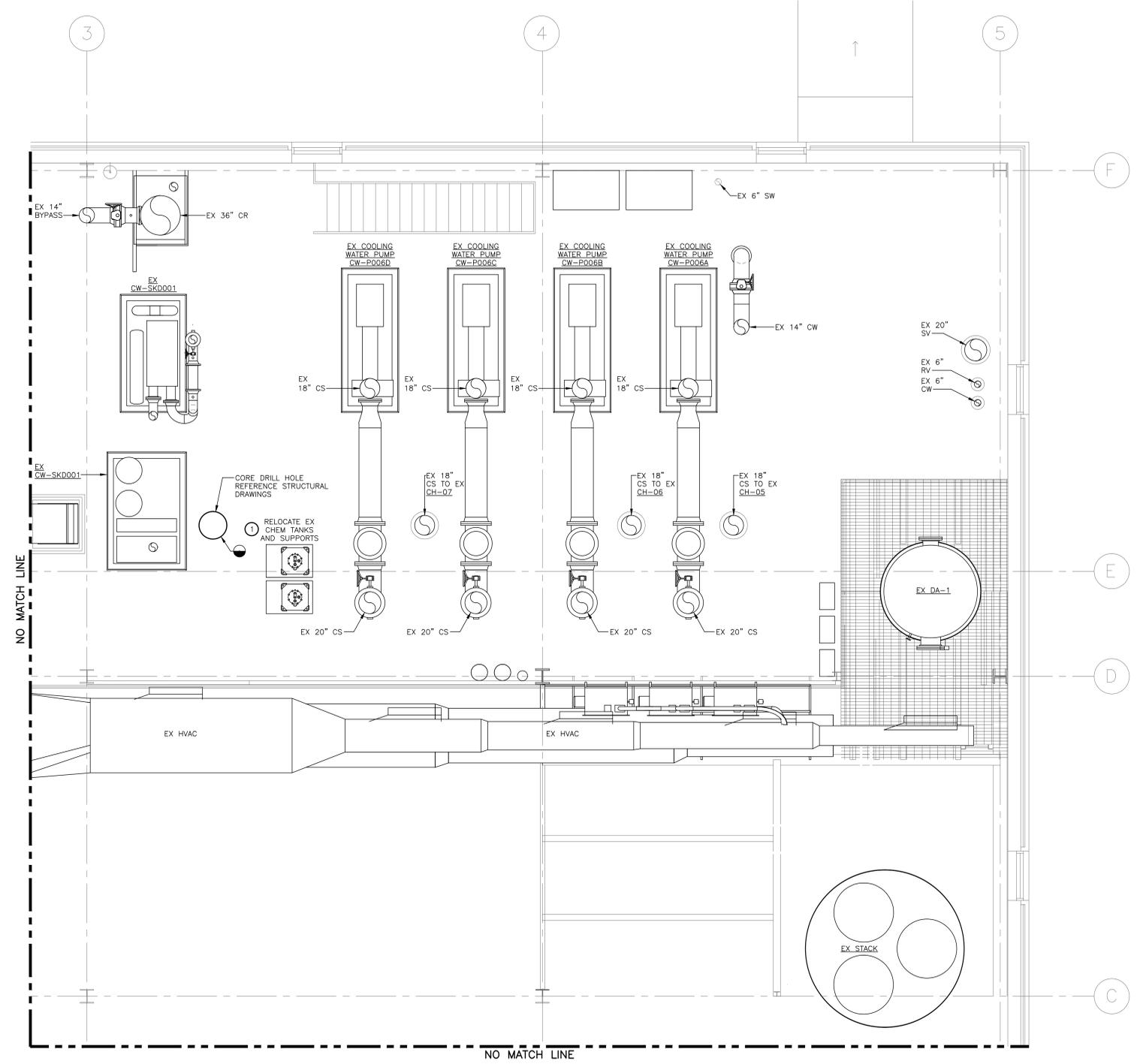
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WORK ORDER NO: #####  
FILE NAME:  
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AUTHOR: WWM  
DRAFTER: RJC  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:

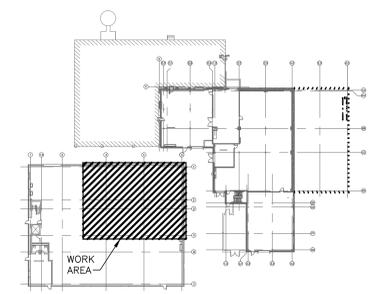
MEZZANINE  
LOWER LEVEL PART  
PLAN - DEMOLITION

SHEET:  
**M1.05**

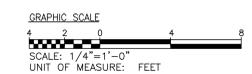
SHEET: 14 of 61



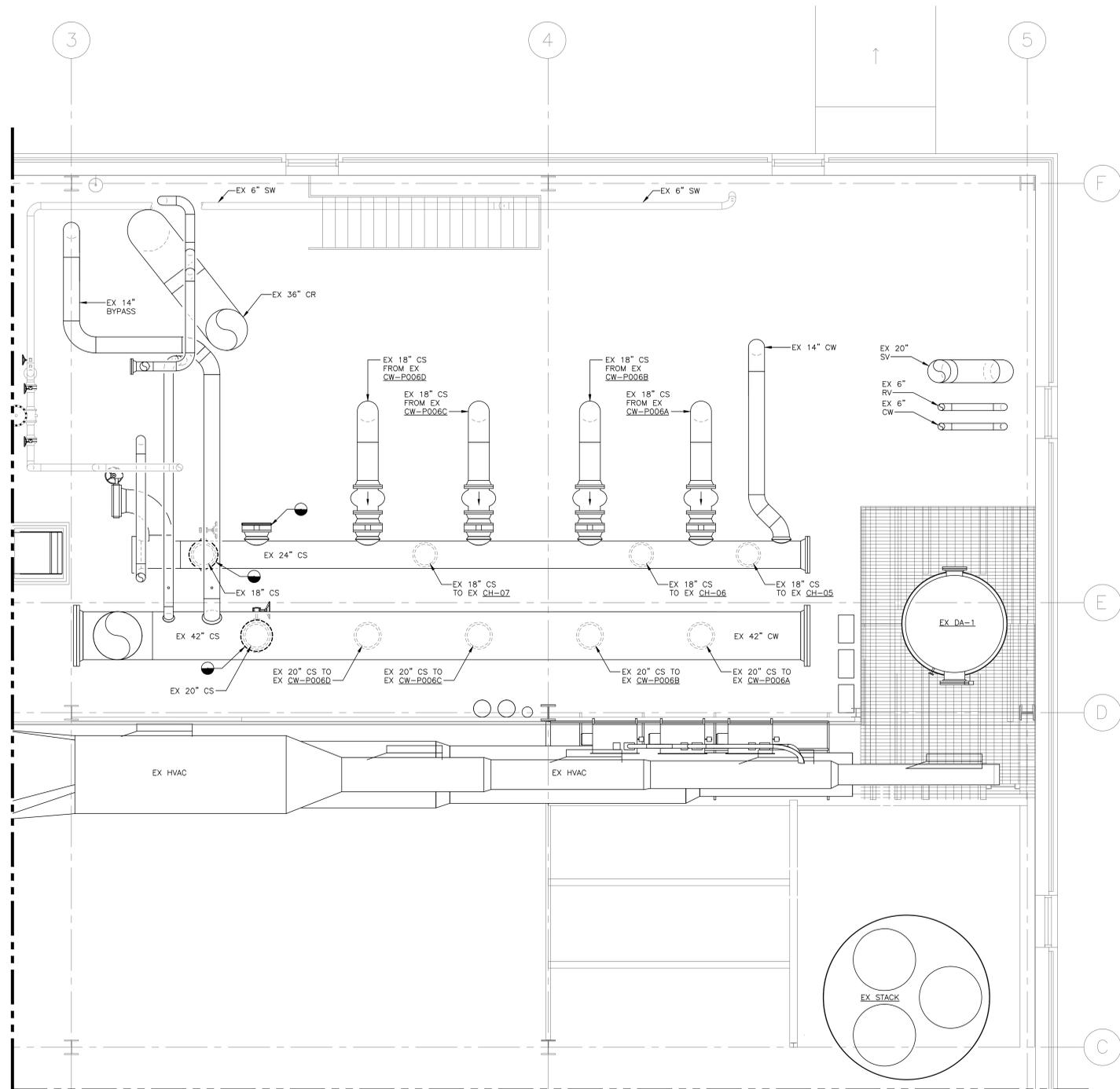
**MEZZANINE LOWER LEVEL**  
SCALE: 1/4" = 1'-0"



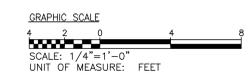
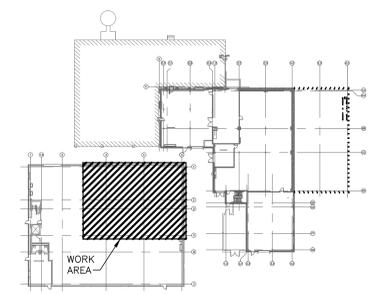
**KEY PLAN**  
SCALE: NONE



GRAPHIC SCALE  
SCALE: 1/4" = 1'-0"  
UNIT OF MEASURE: FEET



**MEZZANINE UPPER LEVEL**  
SCALE: 1/4"=1'-0"



**KEY PLAN**  
SCALE: NONE

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
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ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDDY ROAD UNIT 3038  
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TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M106

AUTHOR: wwm

DRAFTER: rjc

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

PRINT DATE: 05-01-2014

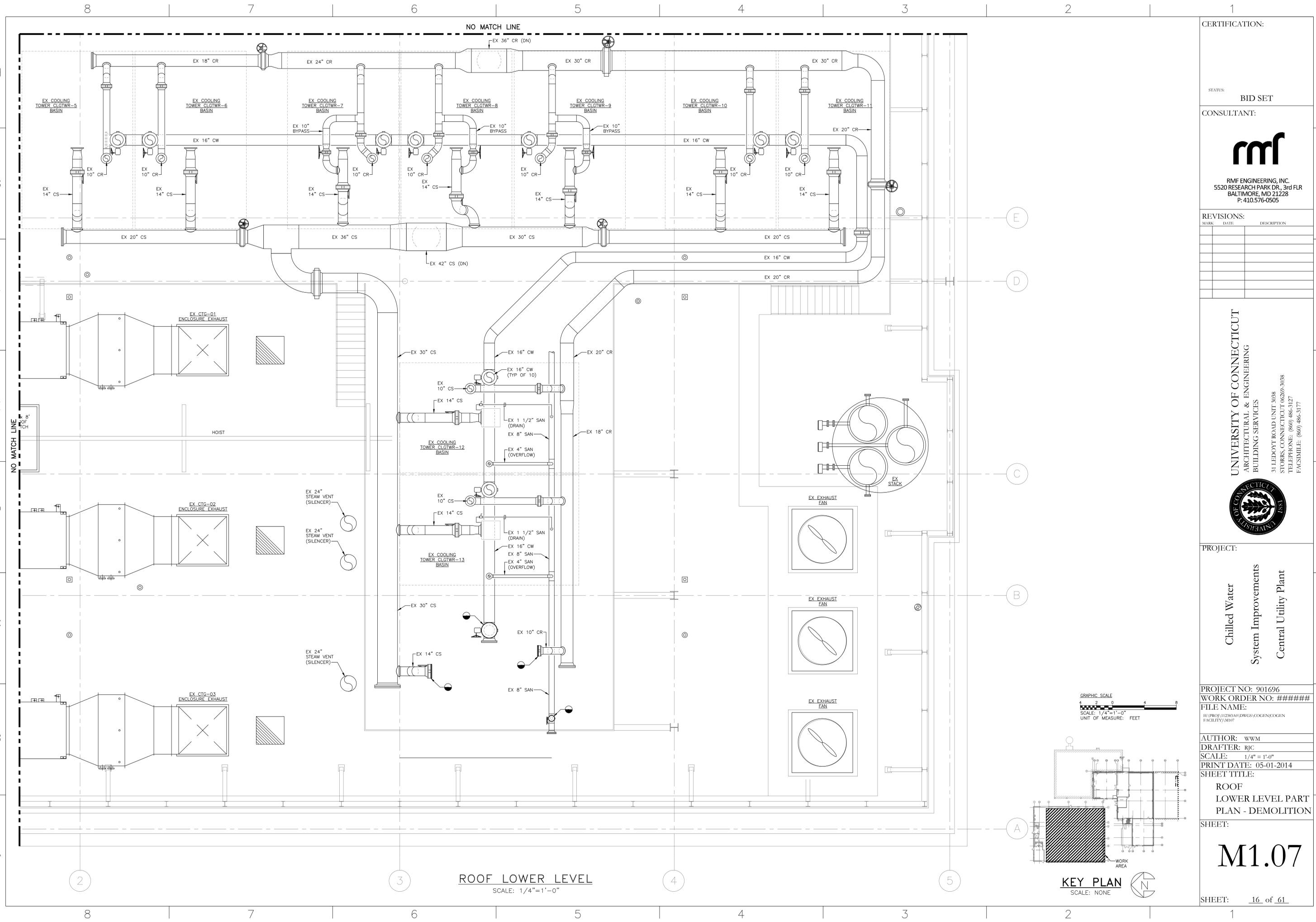
SHEET TITLE:

MEZZANINE  
UPPER LEVEL PART  
PLAN - DEMOLITION

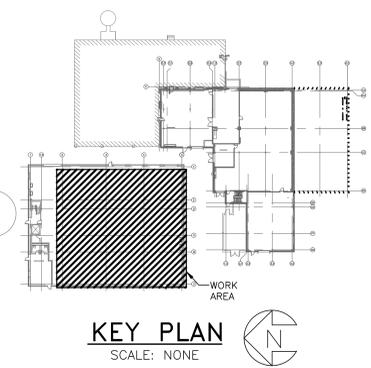
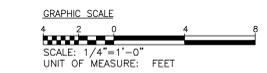
SHEET:

**M1.06**

SHEET: 15 of 61



**ROOF LOWER LEVEL**  
SCALE: 1/4"=1'-0"



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

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BALTIMORE, MD 21228  
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REVISIONS:

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31 LEDDY ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
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FACSIMILE: (860) 486-3177

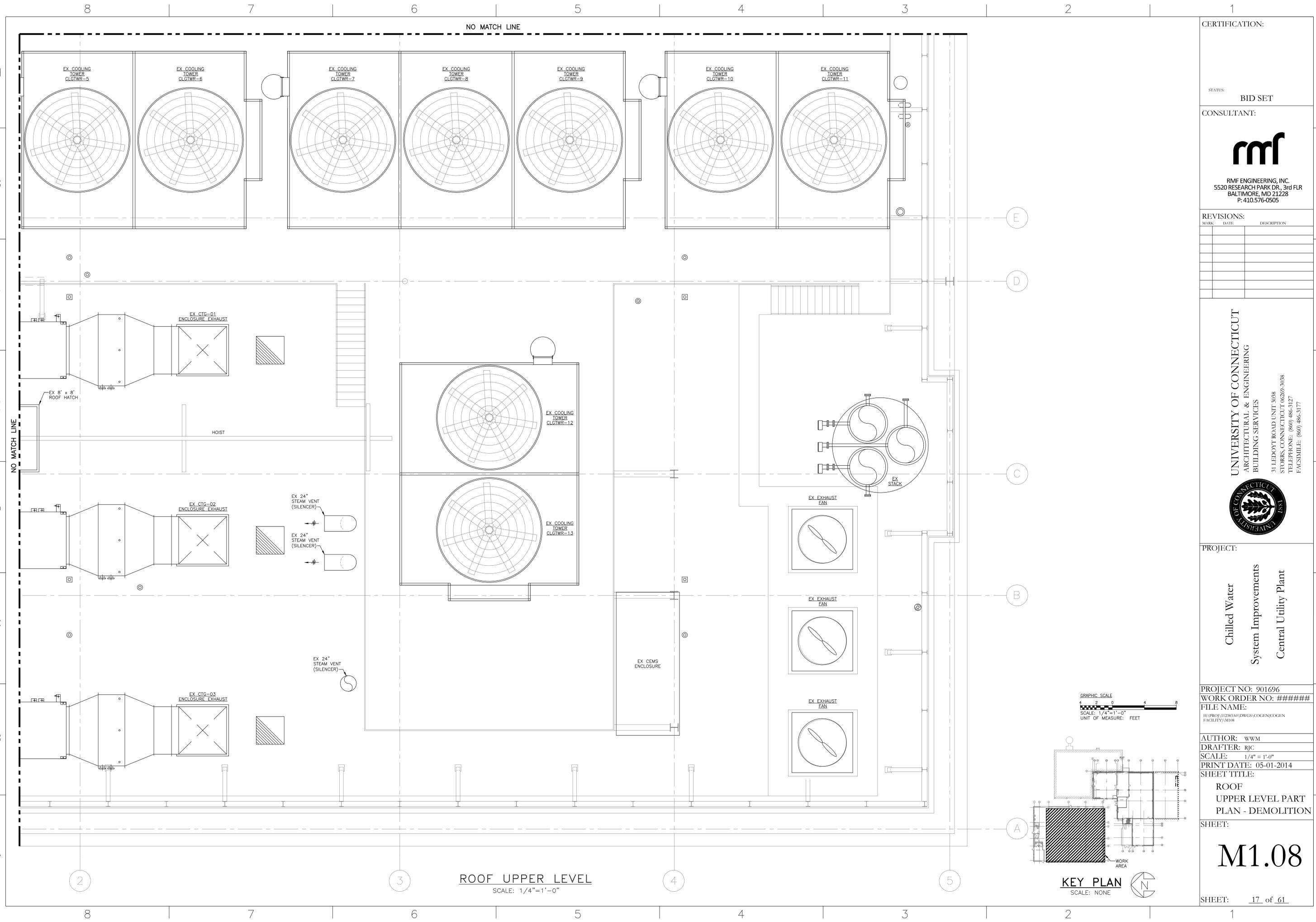
PROJECT:  
**Chilled Water  
System Improvements  
Central Utility Plant**

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
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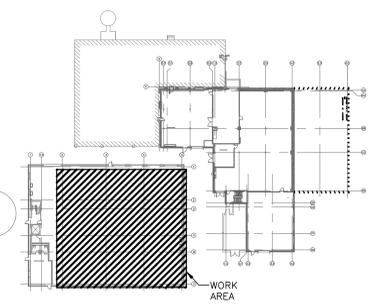
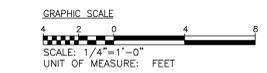
AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/4"=1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
**ROOF  
LOWER LEVEL PART  
PLAN - DEMOLITION**

SHEET:  
**M1.07**

SHEET: 16 of 61



**ROOF UPPER LEVEL**  
SCALE: 1/4"=1'-0"



**KEY PLAN**  
SCALE: NONE

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDOYT ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3177  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

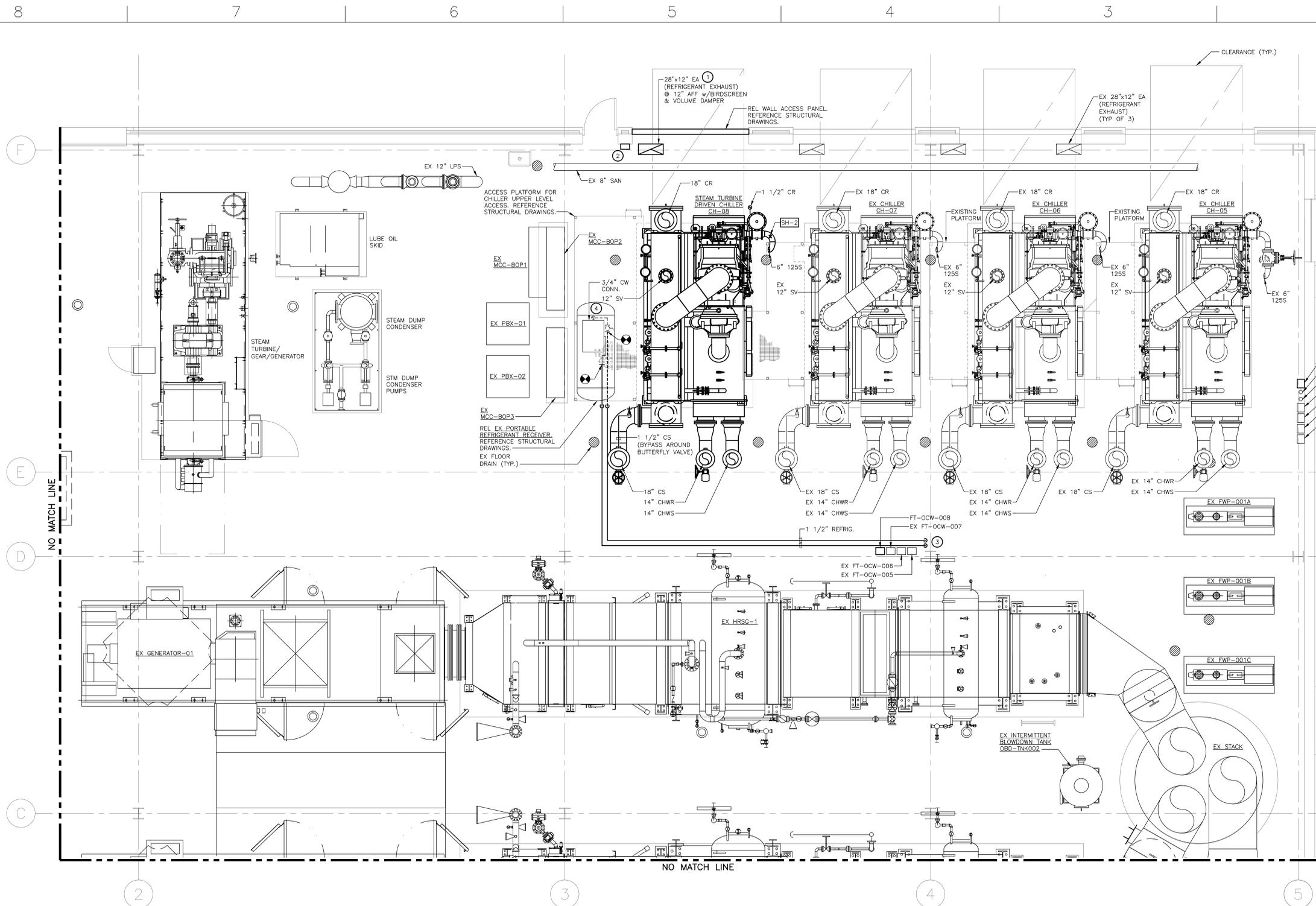
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WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\11283AA\DWGS\COGEN\COGEN FACILITY\M108

AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
ROOF  
UPPER LEVEL PART  
PLAN - DEMOLITION

SHEET:  
**M1.08**

SHEET: 17 of 61





- DRAWING NOTES:**
- BALANCE ALL 8 REFRIGERANT EXHAUST DAMPERS TO UNIFORM FLOW.
  - REFRIGERANT MONITOR IR SENSOR AND AUDIBLE/VISUAL ALARM, CONNECT TO EXISTING SHERLOCK 404 CONTROL MODULE.
  - TERMINATE REFRIGERANT PIPING CONNECTIONS AT 48" AFF.
  - CITY WATER CONNECTIONS SHALL BE FIELD-ROUTED.

CERTIFICATION:  
STATUS: **BID SET**

CONSULTANT:  
**rmf**  
RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES  
31 LEDDY ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:  
Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\M201

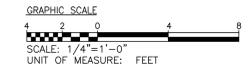
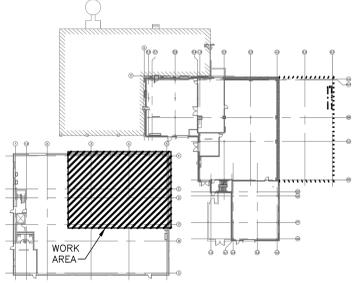
AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:

FIRST FLOOR  
LOWER LEVEL PART  
PLAN - NEW WORK

SHEET:  
**M2.01**

SHEET: 19 of 61

FIRST FLOOR LOWER LEVEL  
SCALE: 1/4" = 1'-0"



KEY PLAN  
SCALE: NONE

**DRAWING NOTES:**  
 ① BALANCE ALL 8 REFRIGERANT EXHAUST DAMPERS TO UNIFORM FLOW.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

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 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M202

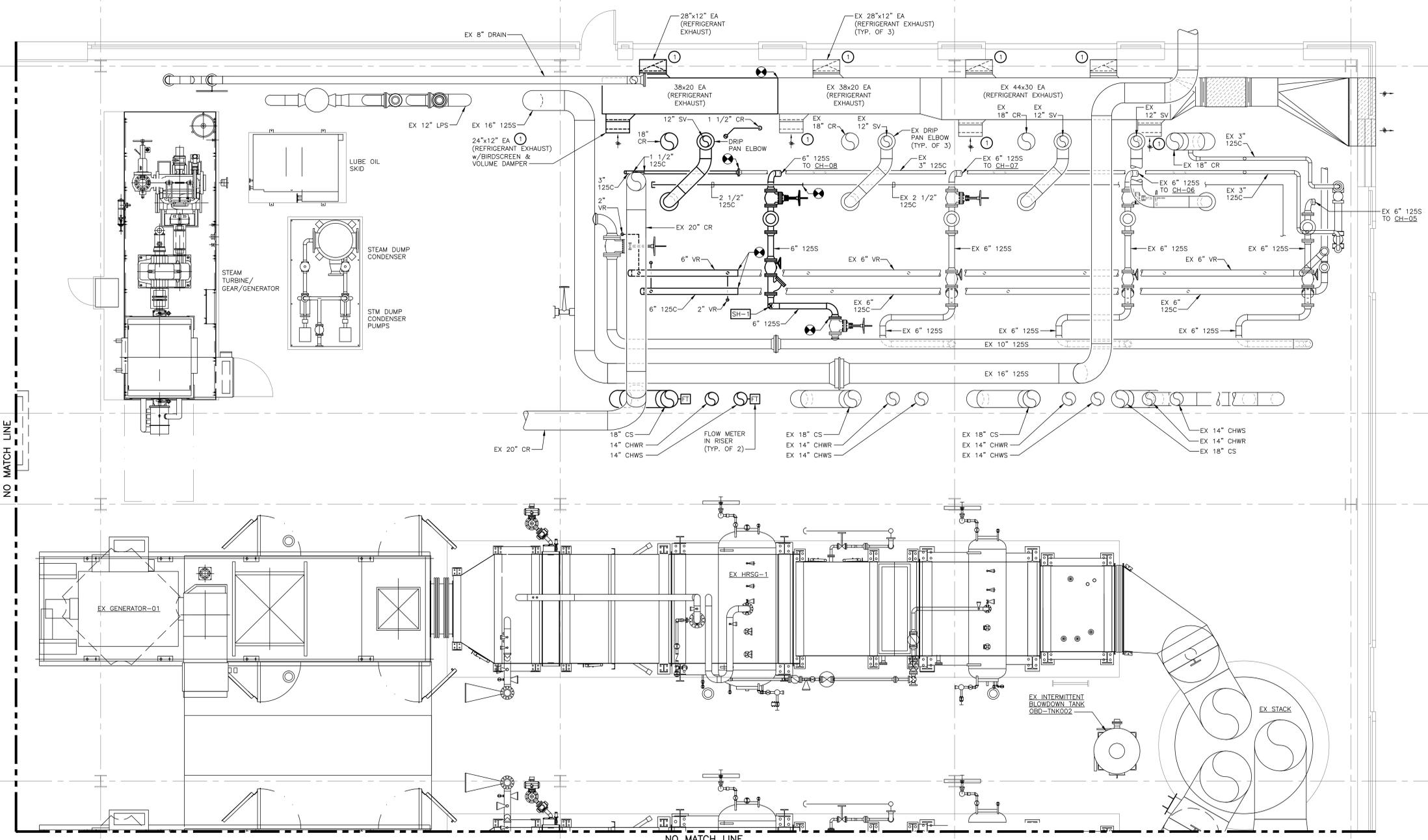
AUTHOR: wwm  
 DRAFTER: rjc  
 SCALE: 1/4" = 1'-0"  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:

FIRST FLOOR  
 UPPER LEVEL PART  
 PLAN - NEW WORK

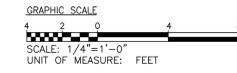
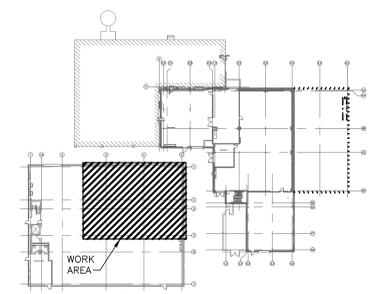
SHEET:

**M2.02**

SHEET: 20 of 61



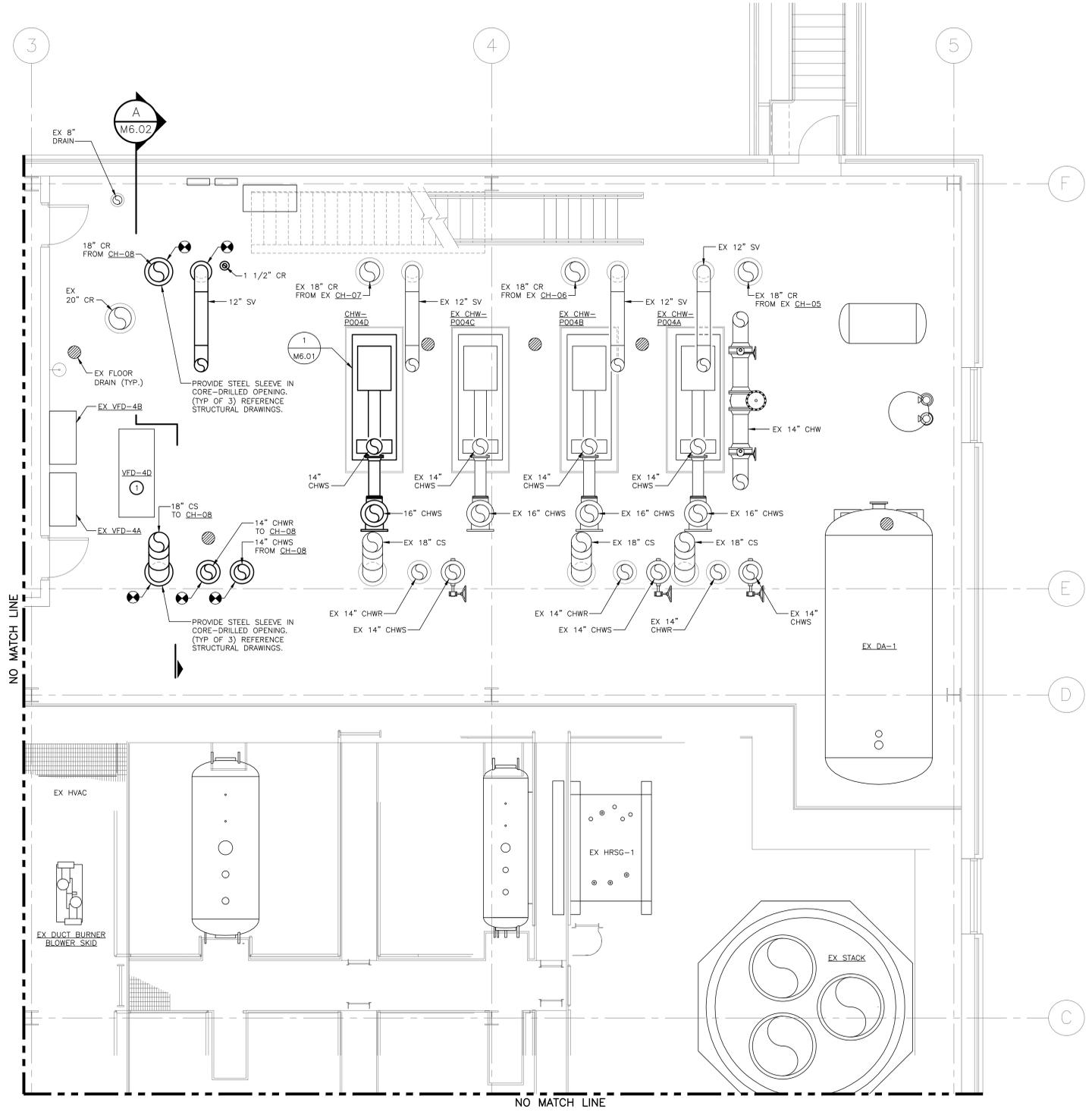
**FIRST FLOOR UPPER LEVEL**  
 SCALE: 1/4" = 1'-0"



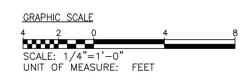
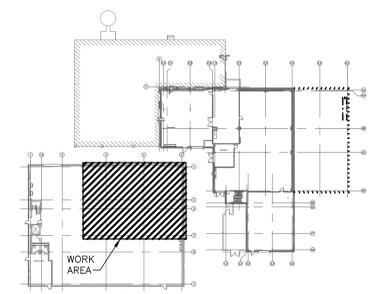
**KEY PLAN**  
 SCALE: NONE



**DRAWING NOTES:**  
 ① DRIP PAN REQUIRED ABOVE ELECTRICAL EQUIPMENT VFD-4D.



**SECOND FLOOR LOWER LEVEL**  
 SCALE: 1/4"=1'-0"



**KEY PLAN**  
 SCALE: NONE

**CERTIFICATION:**

STATUS: **BID SET**

CONSULTANT:

RMF ENGINEERING, INC.  
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 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

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 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177

**PROJECT:**

Chilled Water  
 System Improvements  
 Central Utility Plant

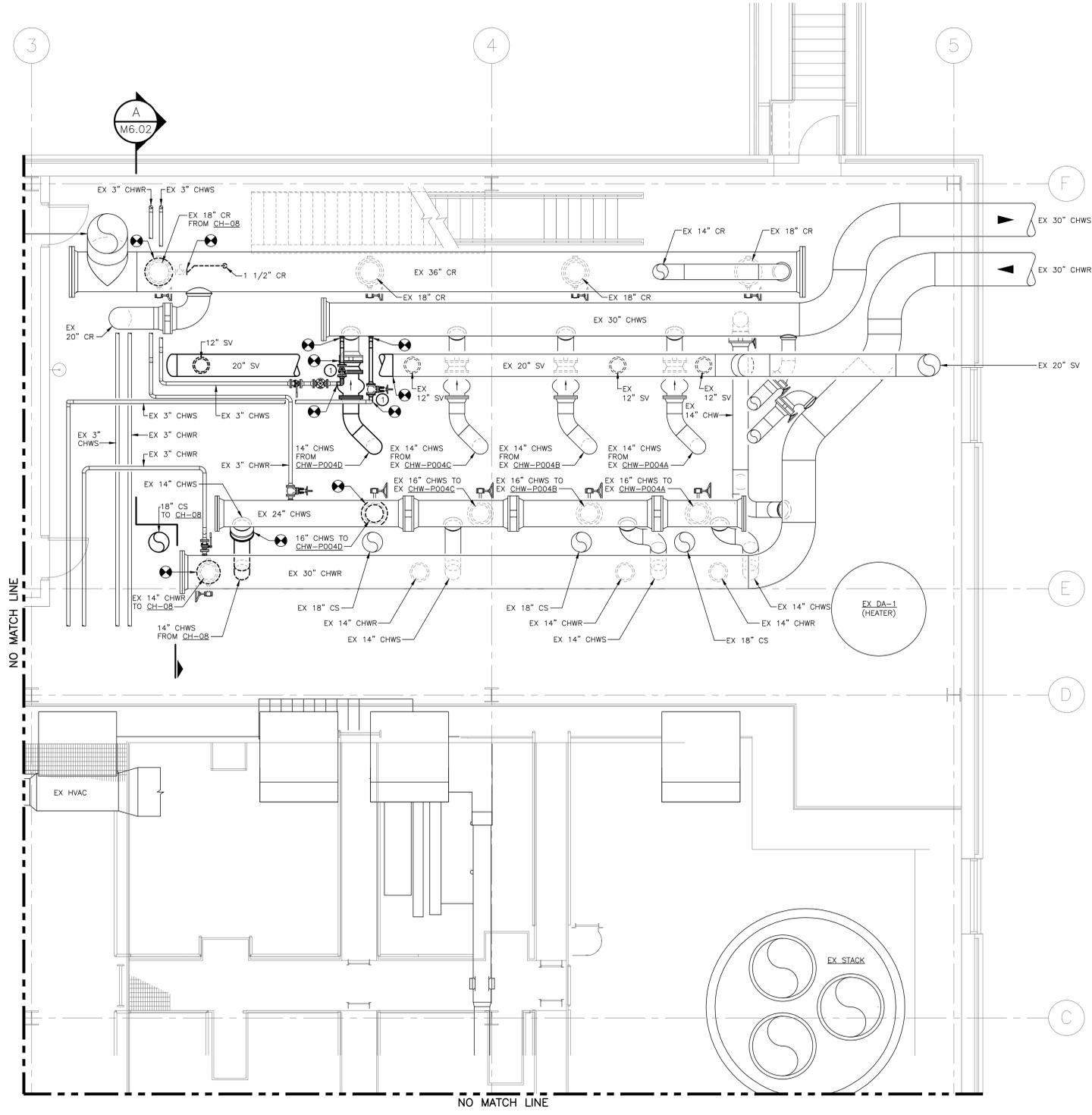
PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M203

AUTHOR: WWM  
 DRAFTER: RJC  
 SCALE: 1/4"=1'-0"  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
 SECOND FLOOR  
 LOWER LEVEL PART  
 PLAN - NEW WORK

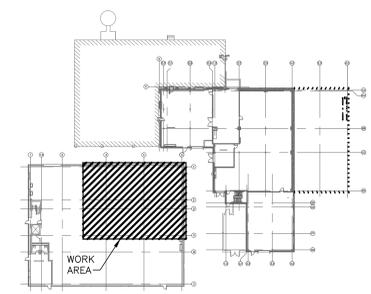
SHEET:  
**M2.03**

SHEET: 21 of 61

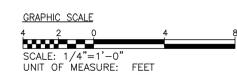
**DRAWING NOTES:**  
 ① RELOCATED VALVES FROM DRAWING M1.04.



**SECOND FLOOR UPPER LEVEL**  
 SCALE: 1/4"=1'-0"



**KEY PLAN**  
 SCALE: NONE



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M204

AUTHOR: wwm

DRAFTER: rjc

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

PRINT DATE: 05-01-2014

SHEET TITLE:

SECOND FLOOR  
 UPPER LEVEL PART  
 PLAN - NEW WORK

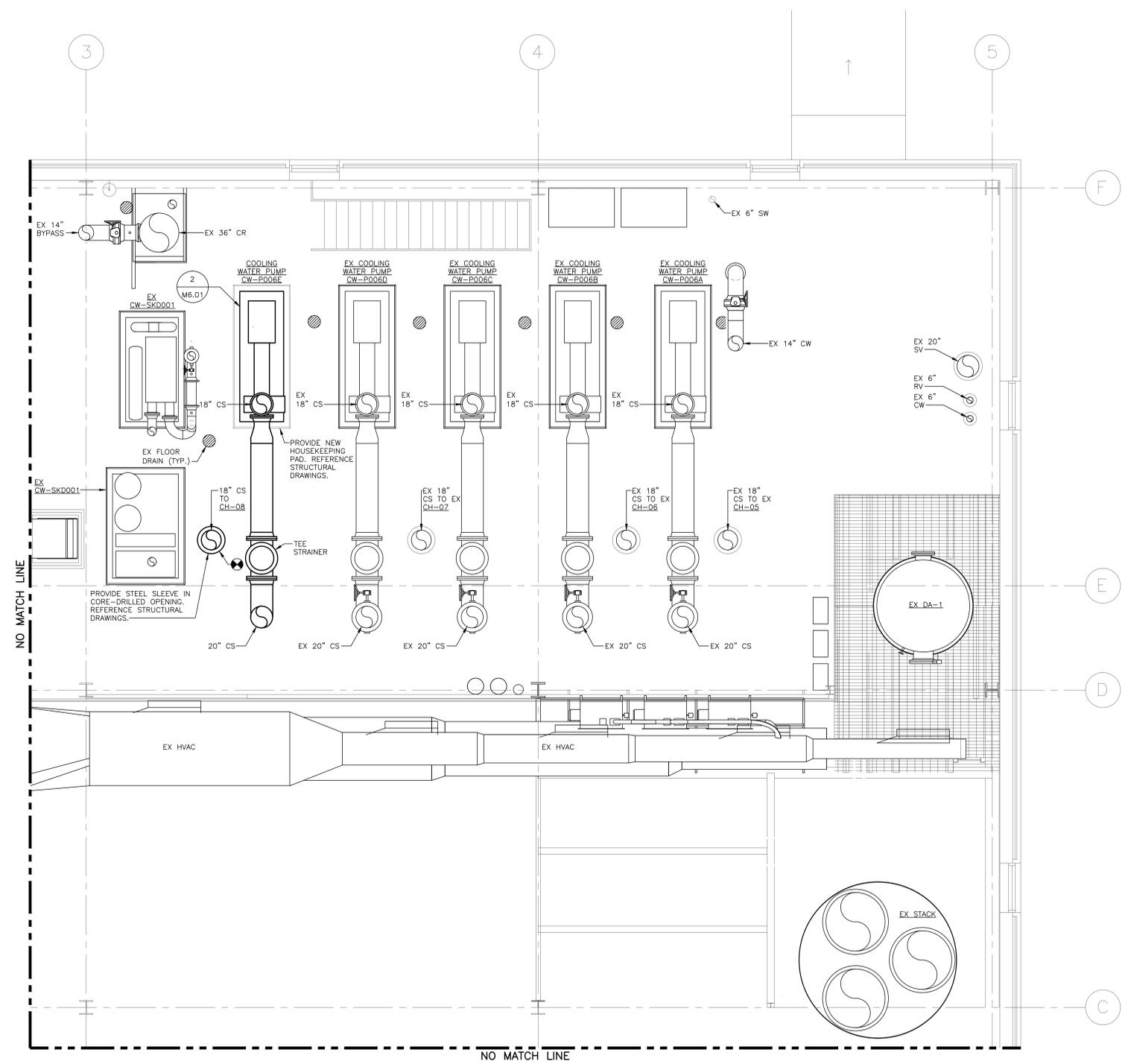
SHEET:

**M2.04**

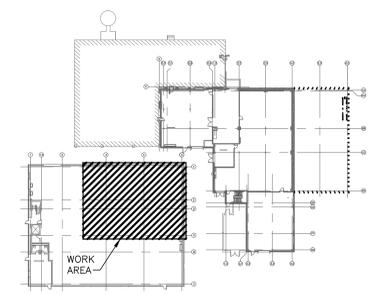
SHEET: 22 of 61

**GENERAL NOTES:**

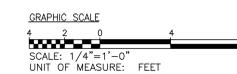
1. CHEMICAL TANKS AND SUPPORT RELOCATION SHALL BE COORDINATED WITH THE UNIVERSITY.



**MEZZANINE LOWER LEVEL**  
SCALE: 1/4"=1'-0"



**KEY PLAN**  
SCALE: NONE



GRAPHIC SCALE  
SCALE: 1/4"=1'-0"  
UNIT OF MEASURE: FEET

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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REVISIONS:

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BUILDING SERVICES

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STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M205

AUTHOR: WWM

DRAFTER: RJC

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

PRINT DATE: 05-01-2014

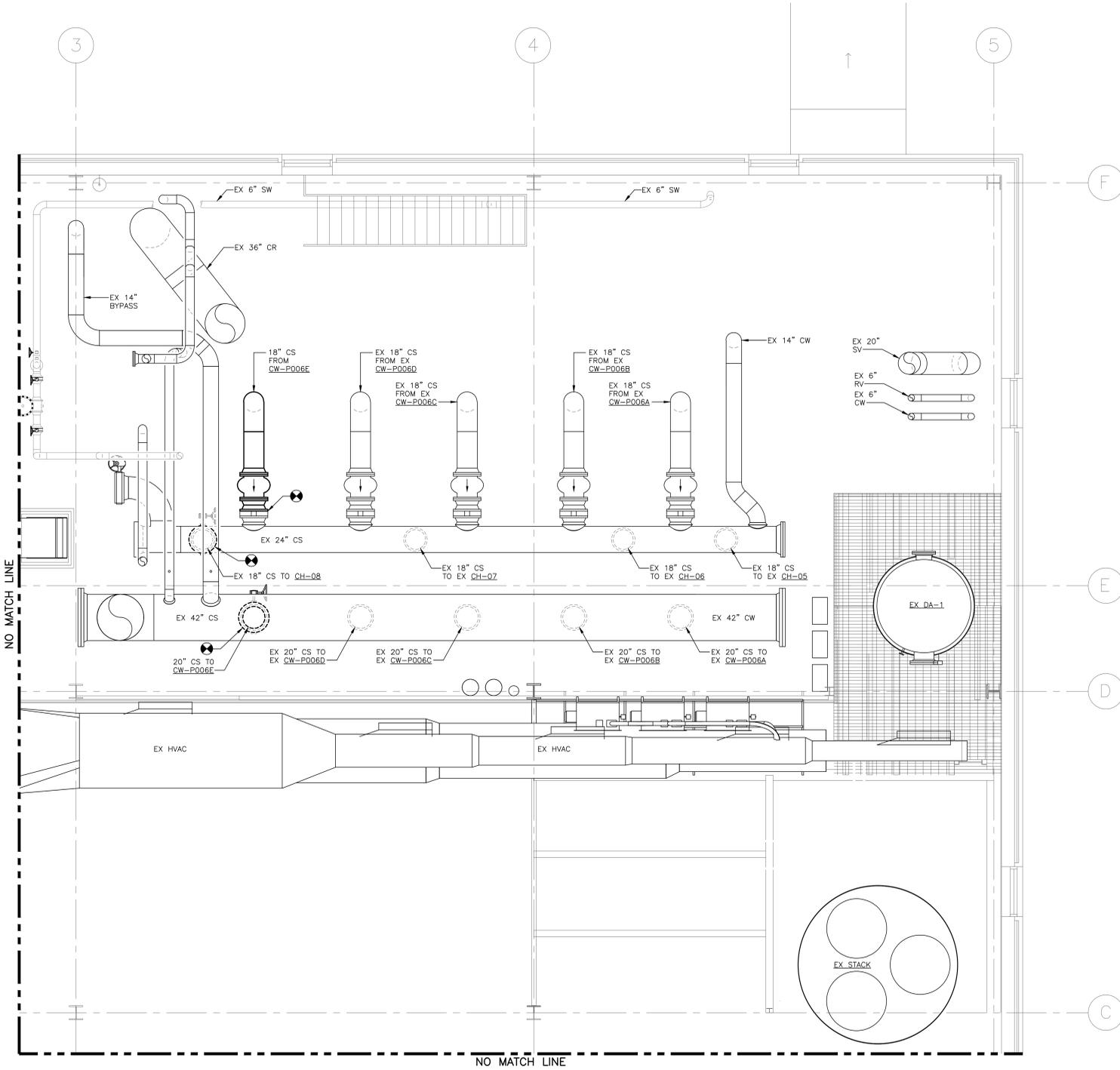
SHEET TITLE:

MEZZANINE  
LOWER LEVEL PART  
PLAN - NEW WORK

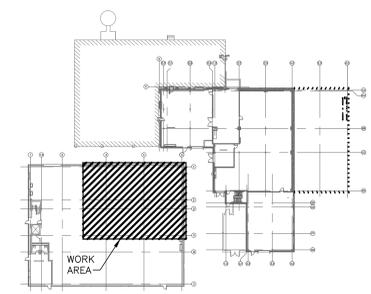
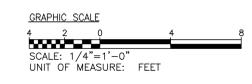
SHEET:

**M2.05**

SHEET: 23 of 61



**MEZZANINE UPPER LEVEL**  
SCALE: 1/4"=1'-0"



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

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5520 RESEARCH PARK DR., 3RD FLR  
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STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

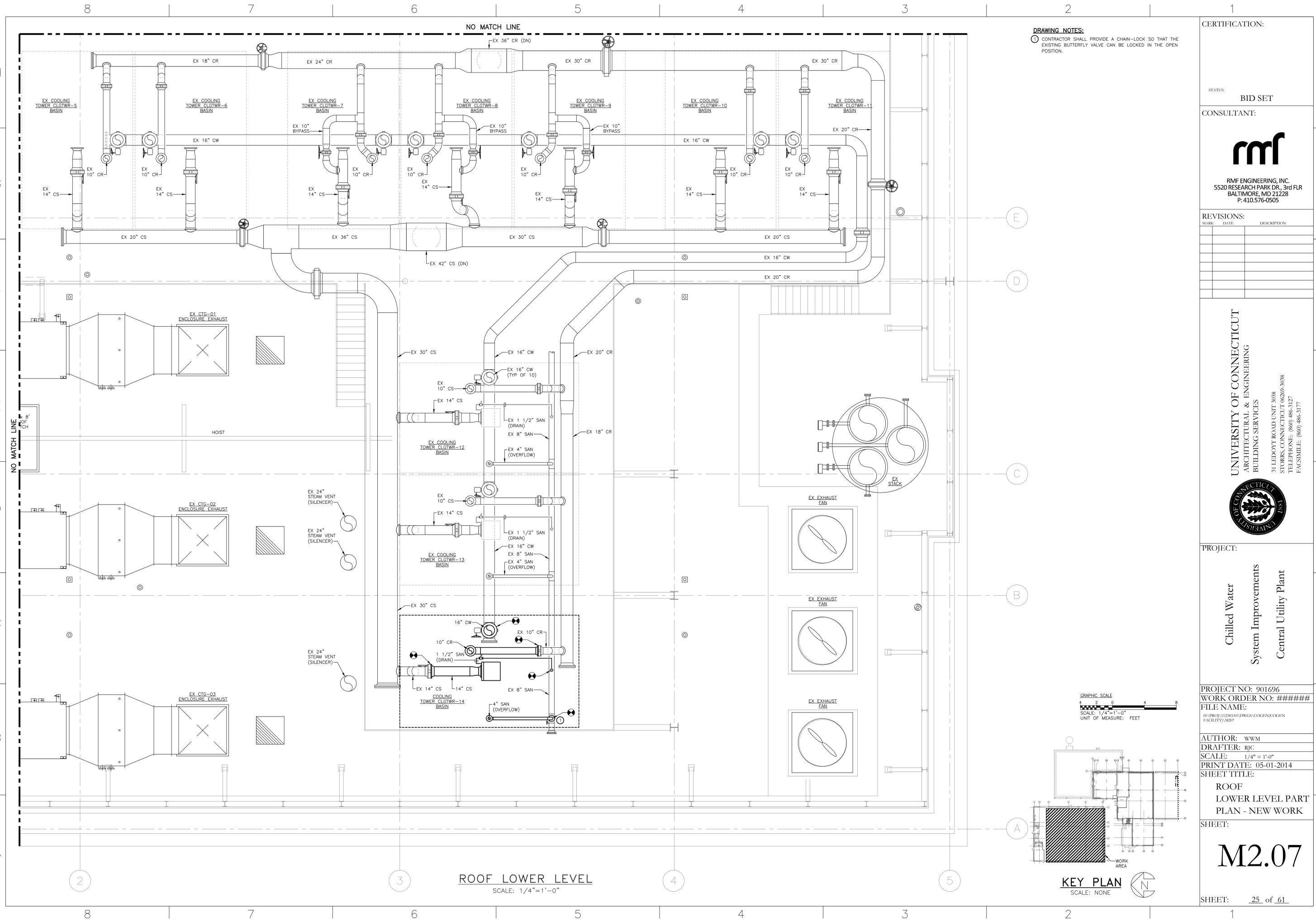
Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M206

AUTHOR: wwm  
DRAFTER: rjc  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
MEZZANINE  
UPPER LEVEL PART  
PLAN - NEW WORK

SHEET:  
**M2.06**

SHEET: 24 of 61



**DRAWING NOTES:**  
 ① CONTRACTOR SHALL PROVIDE A CHAIN-LOCK SO THAT THE EXISTING BUTTERFLY VALVE CAN BE LOCKED IN THE OPEN POSITION.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**  
 RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
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 BUILDING SERVICES  
 31 LEDDY ROAD UNIT 3088  
 STORRS, CONNECTICUT 06269-3088  
 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####

FILE NAME:  
 H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M207

AUTHOR: wwm  
 DRAFTER: rjc  
 SCALE: 1/4" = 1'-0"

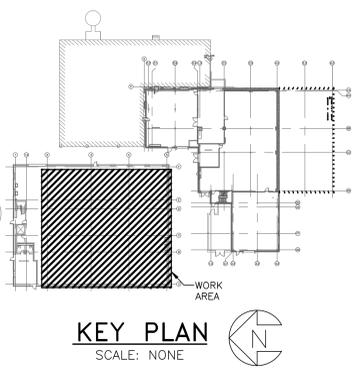
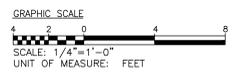
PRINT DATE: 05-01-2014

SHEET TITLE:  
 ROOF LOWER LEVEL PART  
 PLAN - NEW WORK

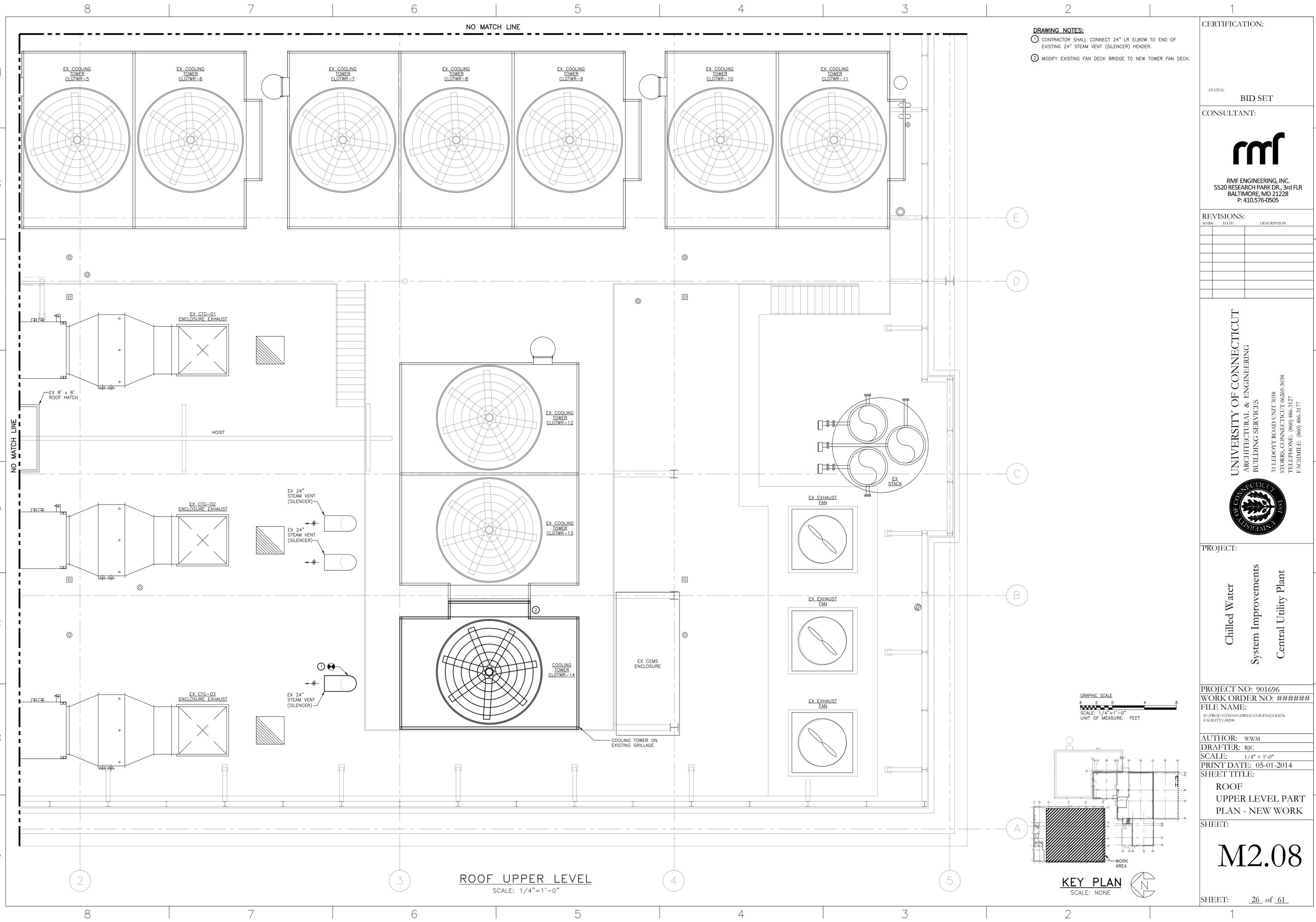
SHEET:

**M2.07**

SHEET: 25 of 61



**ROOF LOWER LEVEL**  
 SCALE: 1/4" = 1'-0"



NO MATCH LINE

NO MATCH LINE

- DRAWING NOTES:**
- ① CONTRACTOR SHALL CONNECT 24" LR ELBOW TO END OF EXISTING 24" STEAM VENT (SILENCER) HEADER.
  - ② MODIFY EXISTING FAN DECK BRIDGE TO NEW TOWER FAN DECK.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES  
31 LEDOYTT ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\M208

AUTHOR: WWM

DRAFTER: RJC

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

PRINT DATE: 05-01-2014

SHEET TITLE:

ROOF  
UPPER LEVEL PART  
PLAN - NEW WORK

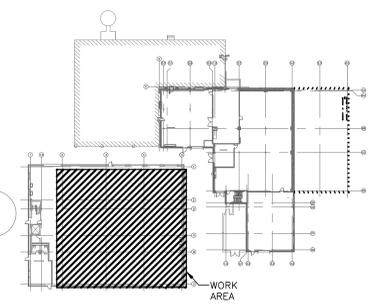
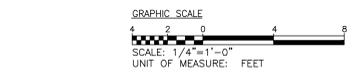
SHEET:

**M2.08**

SCALE: NONE

SHEET: 26 of 61

**ROOF UPPER LEVEL**  
SCALE: 1/4"=1'-0"

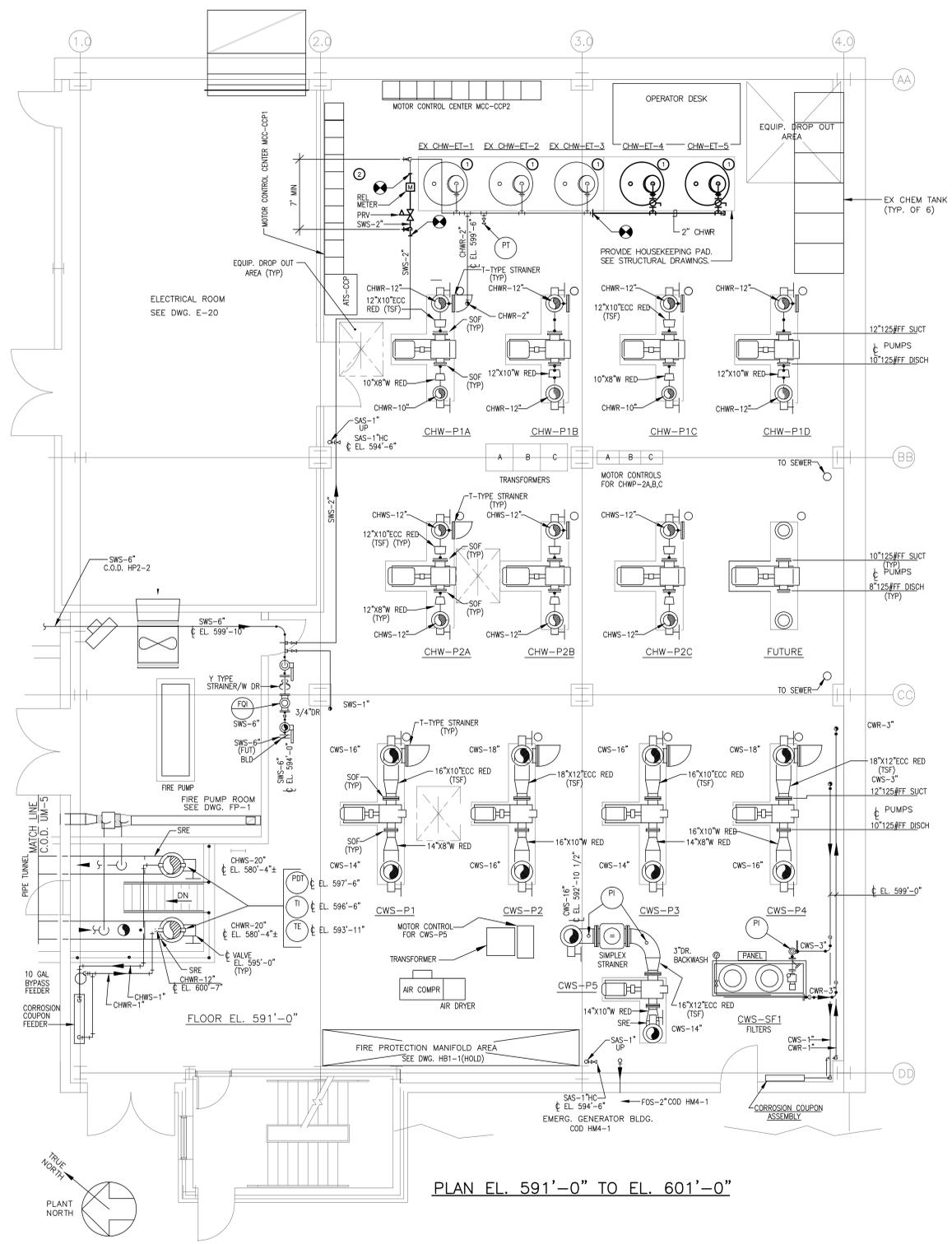


**KEY PLAN**  
SCALE: NONE

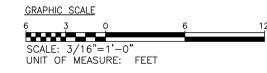
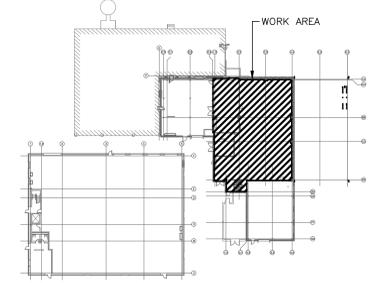


**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE  
 GO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER  
 900886.

**DRAWING NOTES:**  
 ① PROVIDE BLADDER MONITOR ON NEW AND EXISTING EXPANSION  
 TANKS. SUPPLY POWER TO BLADDER MONITORING SYSTEM DEVICES  
 FROM NEAREST 120 VAC PANEL.  
 ② CONTRACTOR SHALL PROVIDE INSULATION TO ANY NEWLY INSTALLED  
 OR RELOCATED PIPE TO MATCH EXISTING PIPE CONDITIONS.



PLAN EL. 591'-0" TO EL. 601'-0"



**KEY PLAN**  
 SCALE: NONE

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
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 31 LEDDY ROAD UNIT 3038  
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 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112283\DWGS\COGEN\COGEN FACILITY\M209

AUTHOR: WWM

DRAFTER: WMB

SCALE: 3/16" = 1'-0"

PRINT DATE: 05-01-2014

SHEET TITLE:

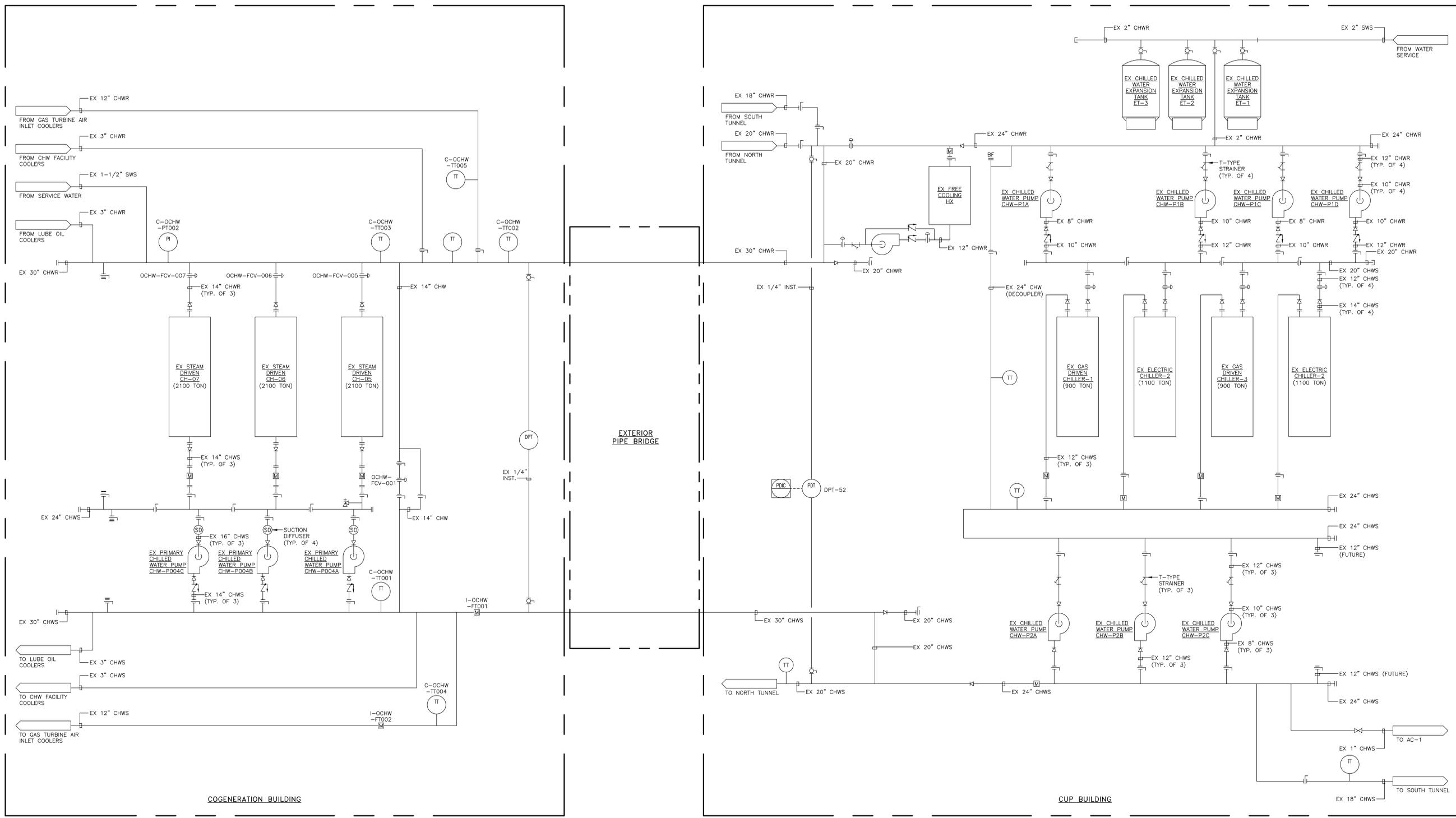
CUP BASEMENT -  
 NEW WORK

SHEET:

**M2.09**

SHEET: 27 of 61

**GENERAL NOTES:**  
 1. THIS DRAWING IS INTENDED TO SHOW THE OVERALL CHILLED WATER GENERATION SYSTEM IN THE CUP AND COGEN PLANTS AND SHALL NOT BE USED FOR CONSTRUCTION.



NOT FOR CONSTRUCTION

**CERTIFICATION:**

STATUS: **BID SET**

CONSULTANT:

**rmf**

RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
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REVISIONS:

MARK	DATE	DESCRIPTION

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 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177

PROJECT:  
**Chilled Water  
 System Improvements  
 Central Utility Plant**

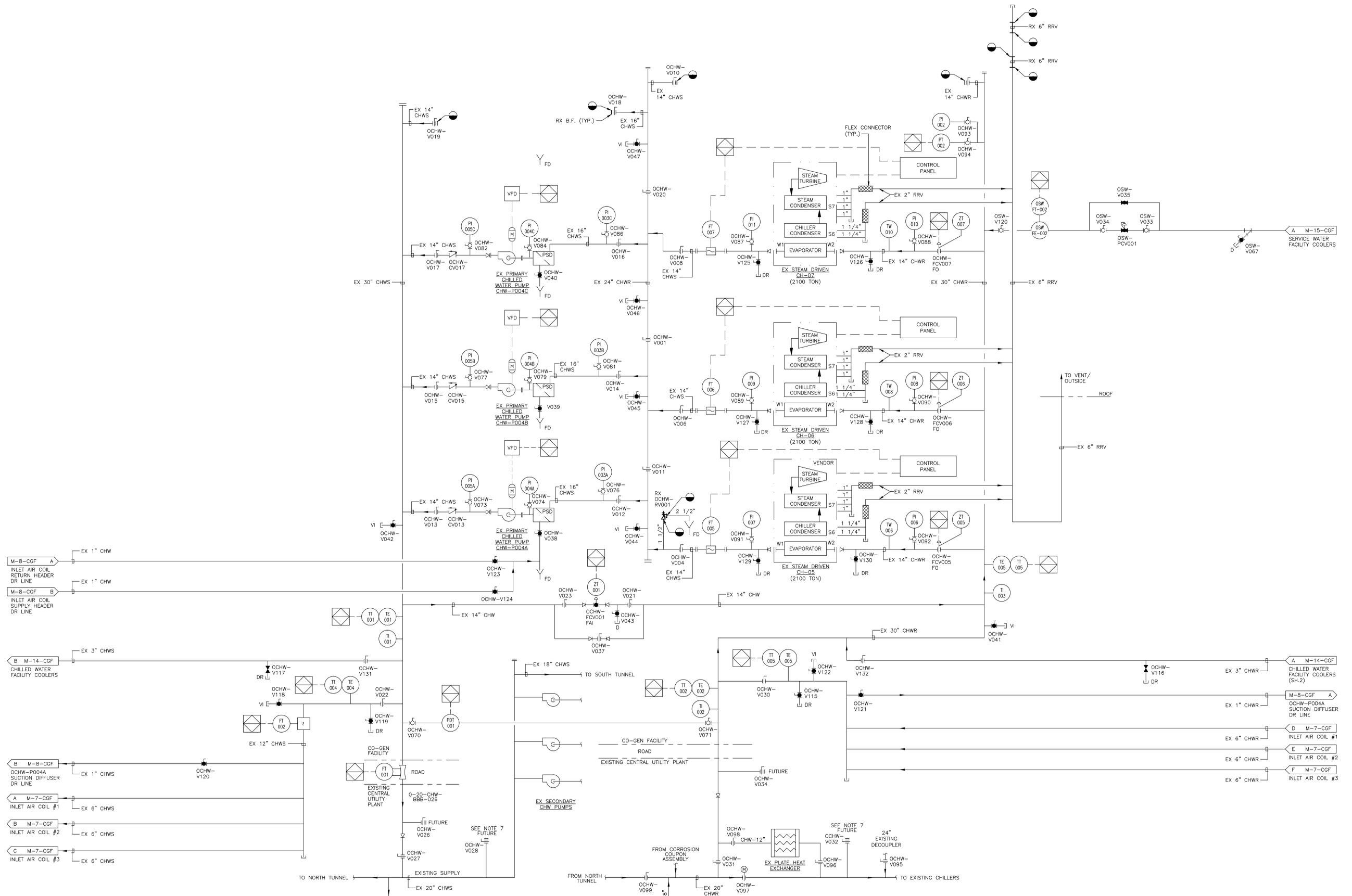
PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\11283\DWGS\COGEN\COGEN FACILITY\M401

AUTHOR: WWM  
 DRAFTER: RIC  
 SCALE: NONE  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
**OVERALL CHILLED WATER  
 SCHEMATIC COGEN  
 & CUP - DEMOLITION**

SHEET:  
**M4.01**

SHEET: 28 of 61

**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE  
 CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER  
 900886.



**CERTIFICATION:**

STATUS: **BID SET**

CONSULTANT:

**rmf**  
 RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

PROJECT:

**Chilled Water  
 System Improvements  
 Central Utility Plant**

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M402

AUTHOR: WWM  
 DRAFTER: RJC  
 SCALE: NONE  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
**COGEN PLANT  
 CHILLED WATER  
 P&ID - DEMOLITION**

SHEET:  
**M4.02**

SHEET: 29 of 61

UNIVERSITY OF CONNECTICUT  
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 FACSIMILE: (860) 486-3177



**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE  
 CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER  
 900886.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11288A\DWGS\COGEN\COGEN FACILITY\M403

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

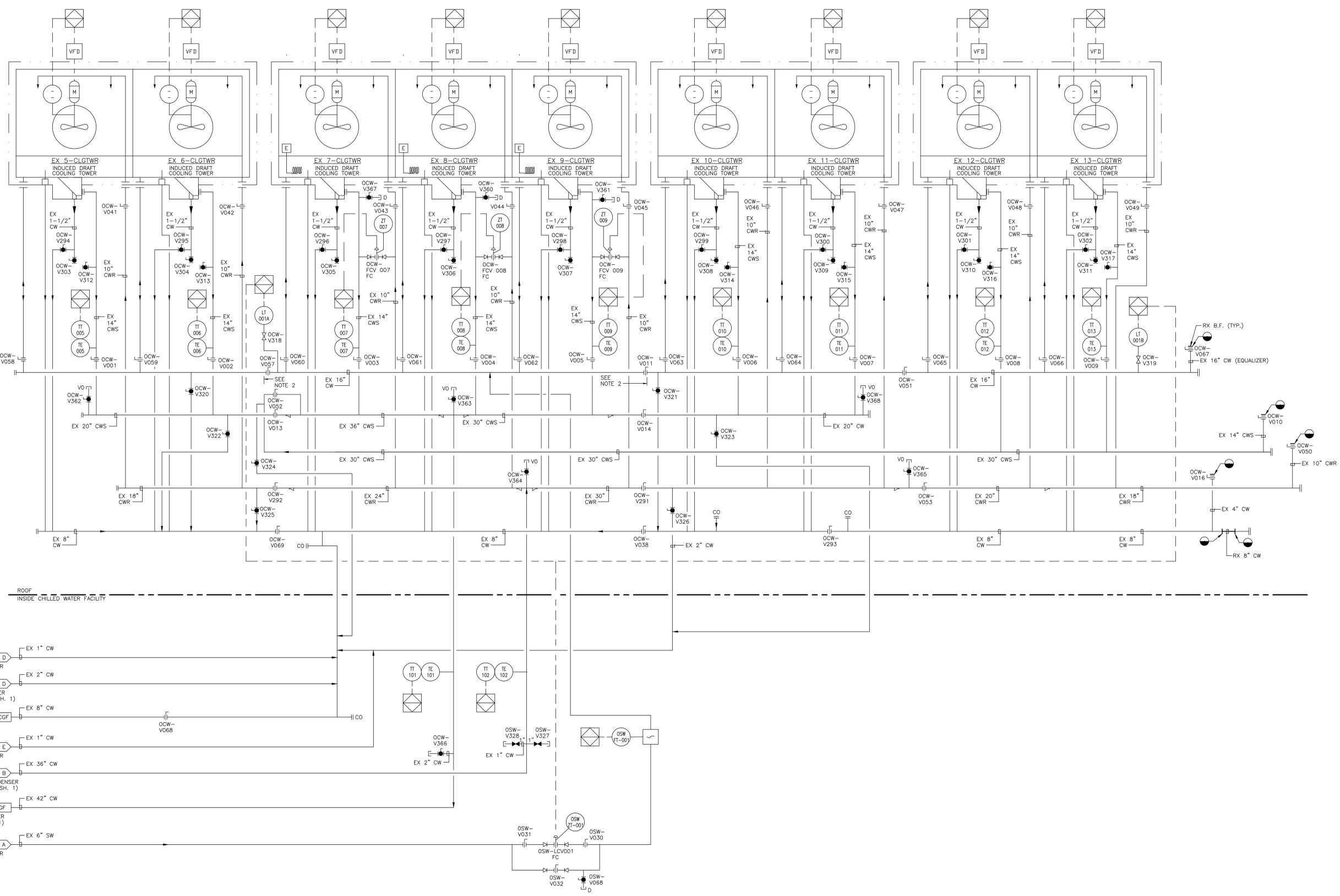
SHEET TITLE:

COGEN PLANT  
 CONDENSER WATER  
 P&ID - DEMOLITION

SHEET:

**M4.03**

SHEET: 30 of 61



**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE  
 CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER  
 900886.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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 FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M404

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

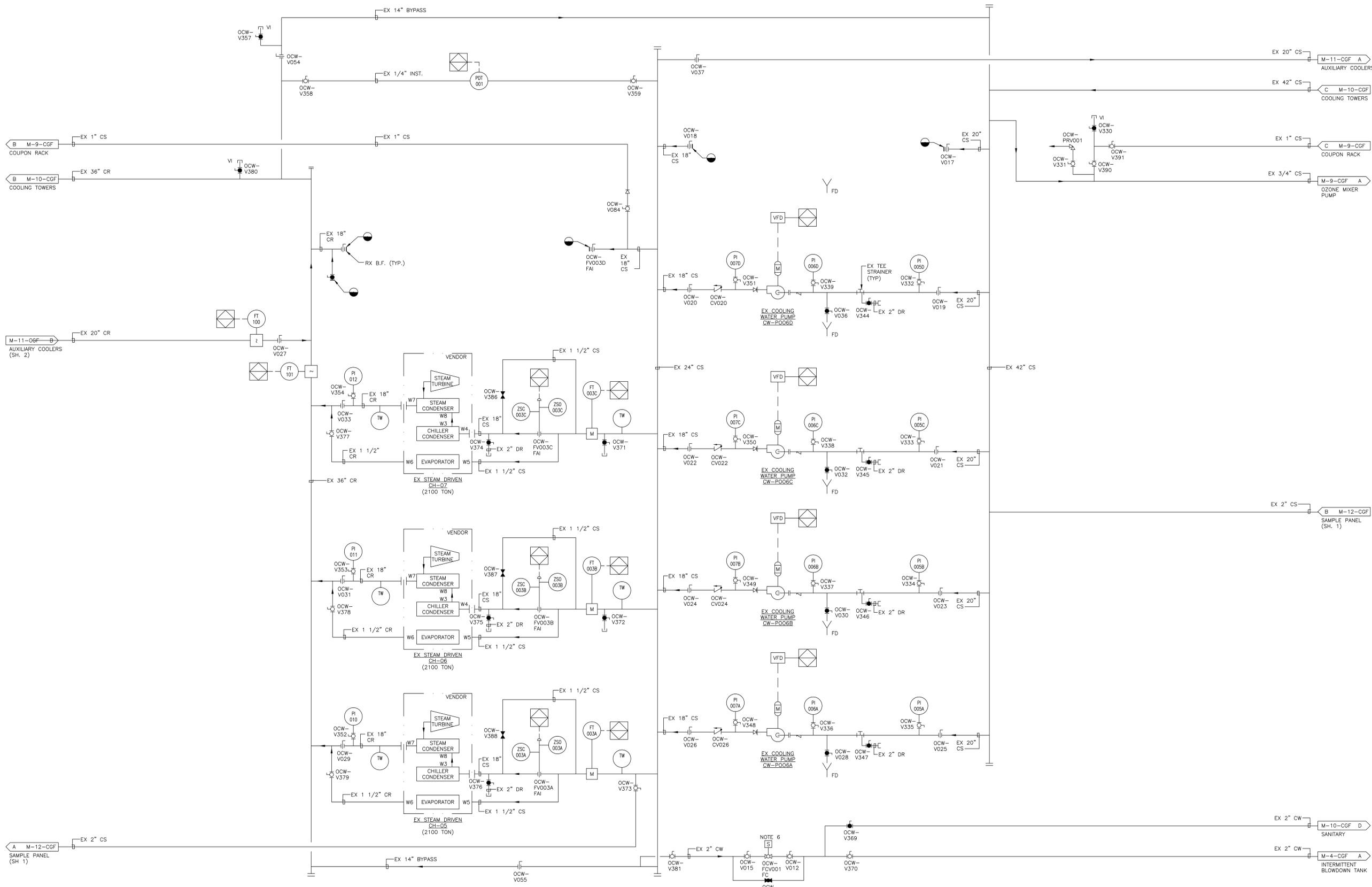
SHEET DATE:

COGEN PLANT  
 CONDENSER WATER  
 P&ID - DEMOLITION

SHEET:

M4.04

SHEET: 31 of 61



**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.

CERTIFICATION:  
  
 STATUS: **BID SET**

CONSULTANT:  
  
  
 RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

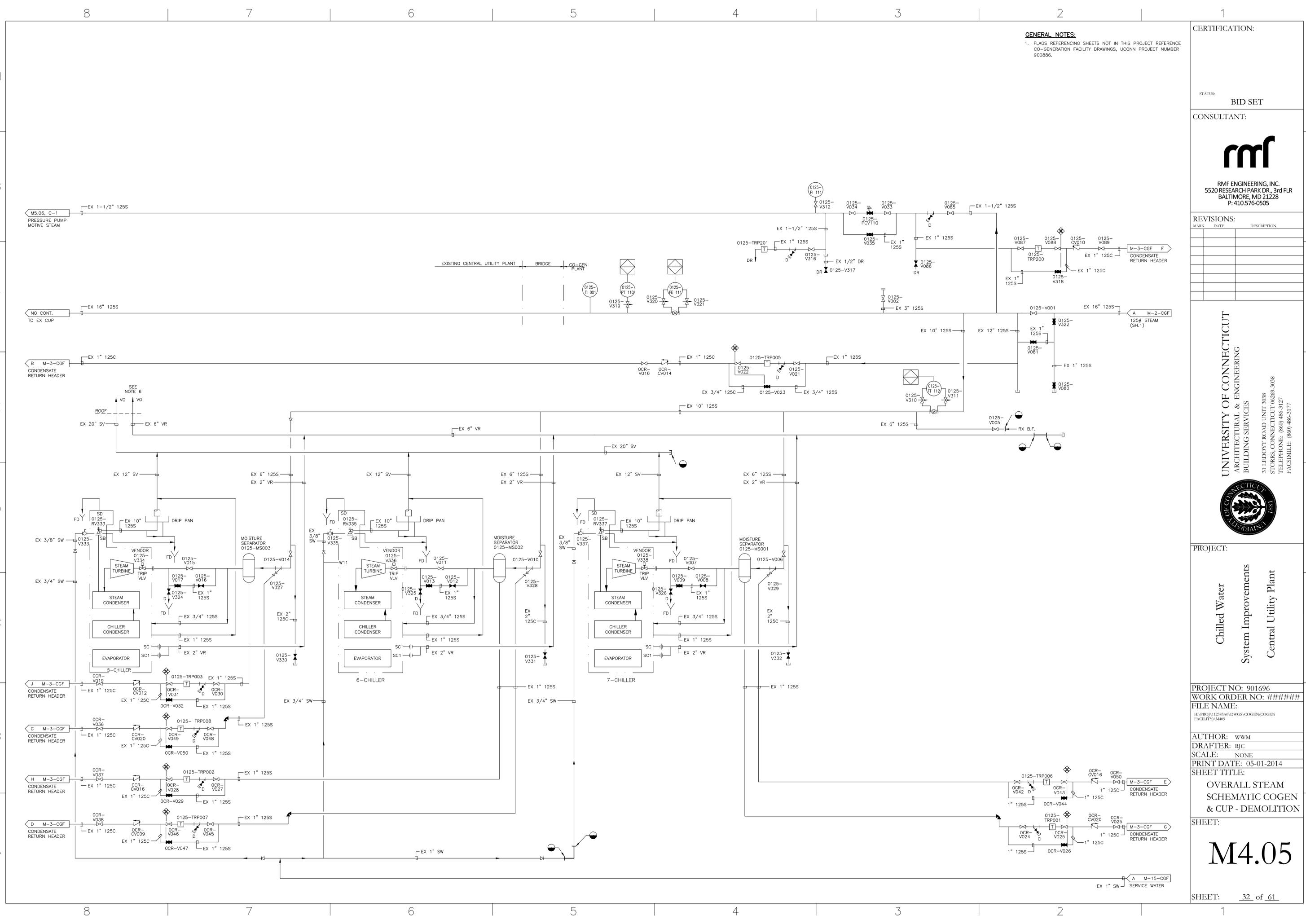
UNIVERSITY OF CONNECTICUT  
 ARCHITECTURAL & ENGINEERING  
 BUILDING SERVICES  
 31 LEDDY ROAD UNIT 3088  
 STORRS, CONNECTICUT 06269-3088  
 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177



PROJECT:  
 Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\11288A\DWGS\COGEN\COGEN FACILITY\M405  
 AUTHOR: wwm  
 DRAFTER: RIC  
 SCALE: NONE  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
 OVERALL STEAM  
 SCHEMATIC COGEN  
 & CUP - DEMOLITION

SHEET:  
**M4.05**  
 SHEET: 32 of 61



**GENERAL NOTES:**  
 1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE  
 CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER  
 900886.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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REVISIONS:

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 FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\M406

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

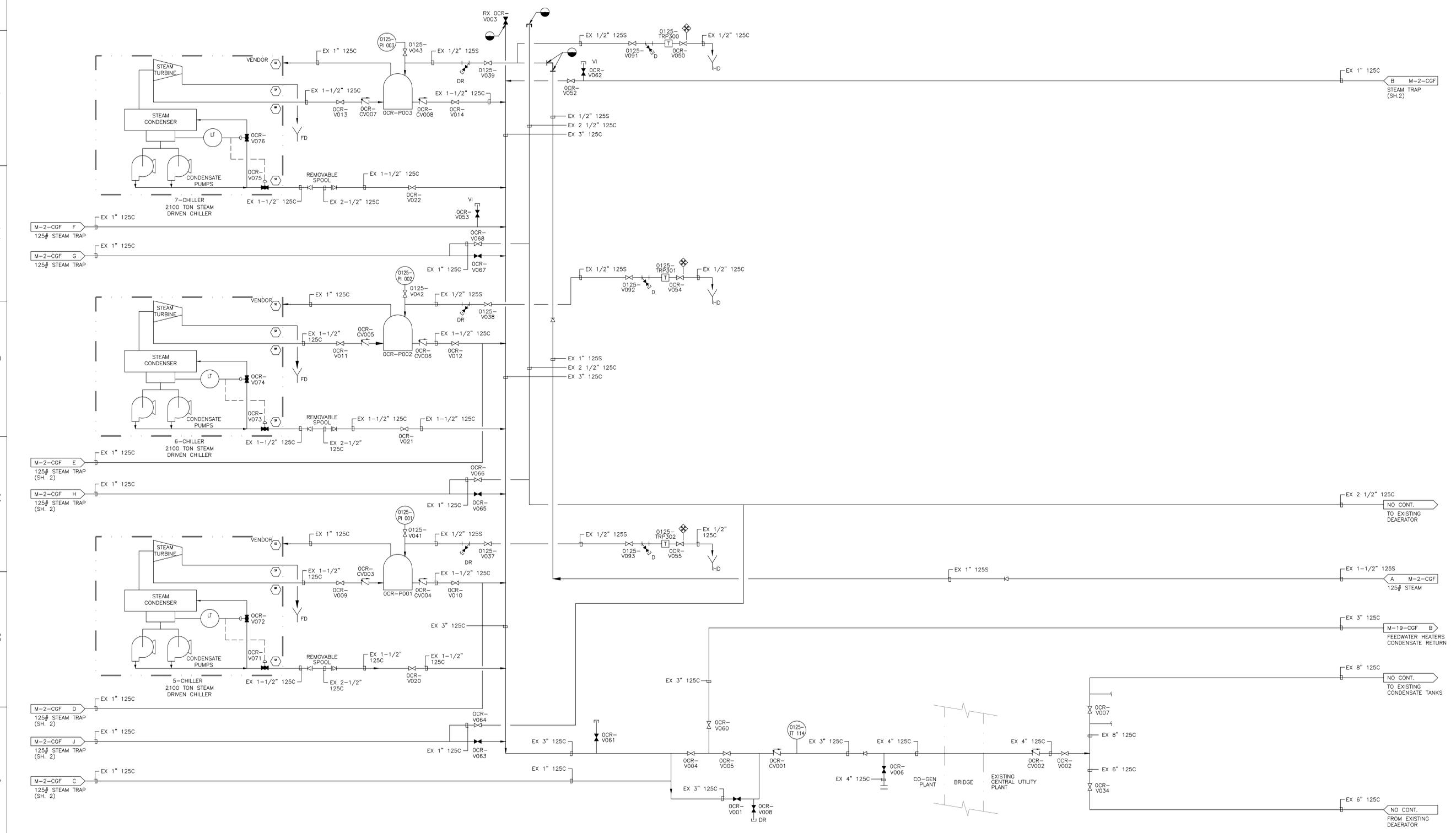
SHEET TITLE:

OVERALL CONDENSATE  
 SCHEMATIC COGEN  
 & CUP - DEMOLITION

SHEET:

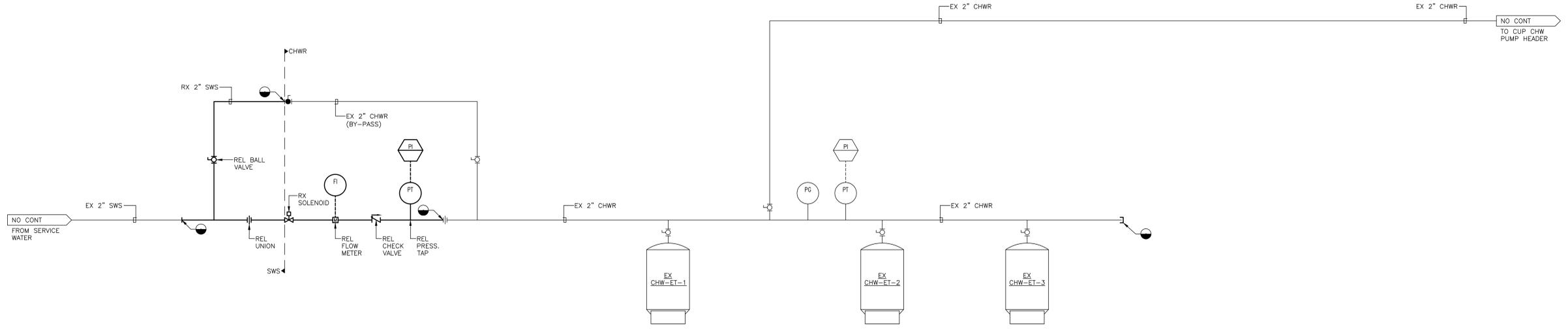
**M4.06**

SHEET: 33 of 61



8 7 6 5 4 3 2 1

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CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M409

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

SHEET TITLE:

MAKE-UP SYSTEM AND  
EXPANSION TANKS  
- DEMOLITION

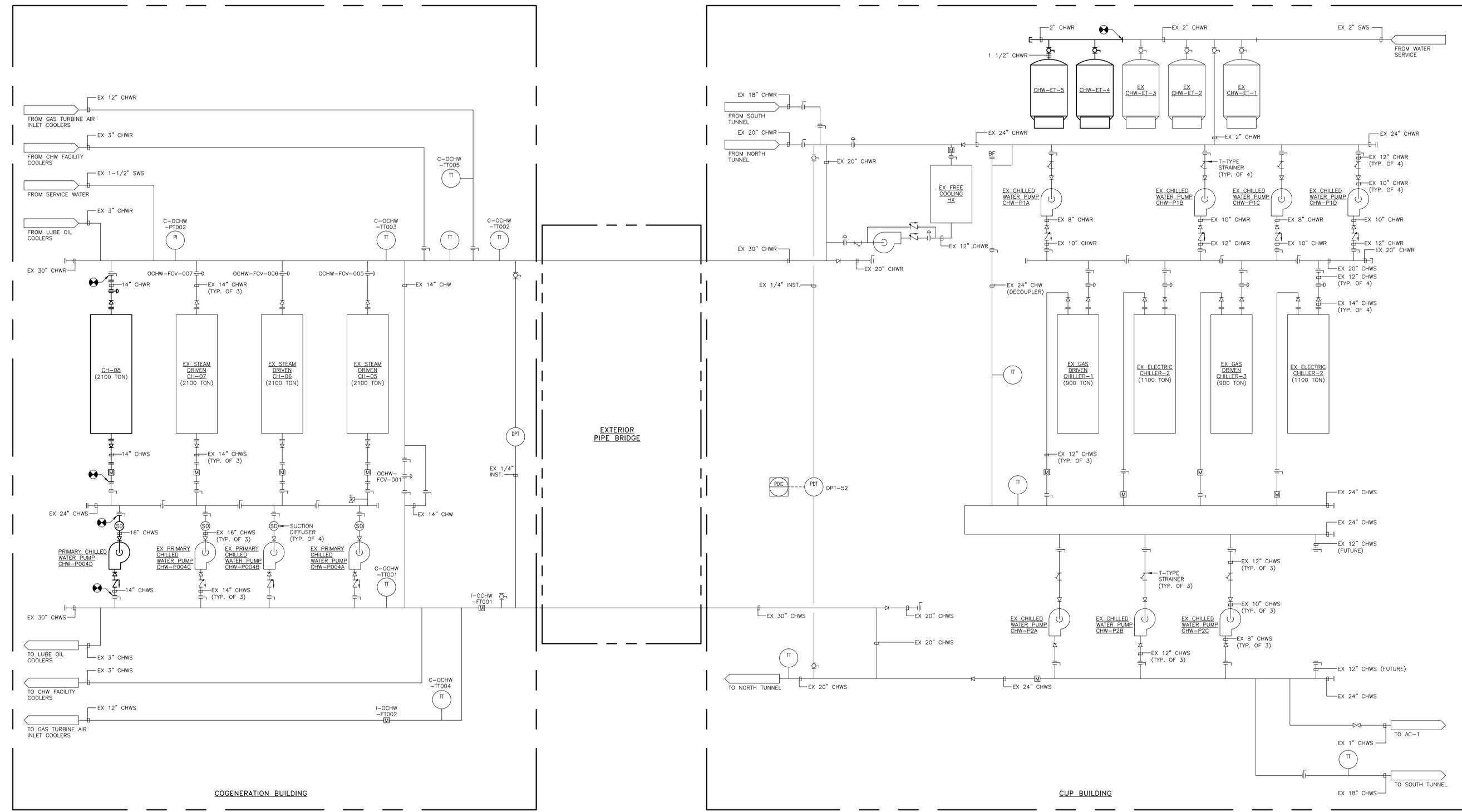
SHEET:

**M4.09**

SHEET: 34 of 61

8 7 6 5 4 3 2 1

**GENERAL NOTES:**  
 1. THIS DRAWING IS INTENDED TO SHOW THE OVERALL CHILLED WATER GENERATION SYSTEM IN THE CUP AND COGEN PLANTS AND SHALL NOT BE USED FOR CONSTRUCTION.



EXTERIOR  
PIPE BRIDGE

NOT FOR CONSTRUCTION

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**

**rmf**

RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
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**REVISIONS:**

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**PROJECT:**

Chilled Water  
System Improvements  
Central Utility Plant

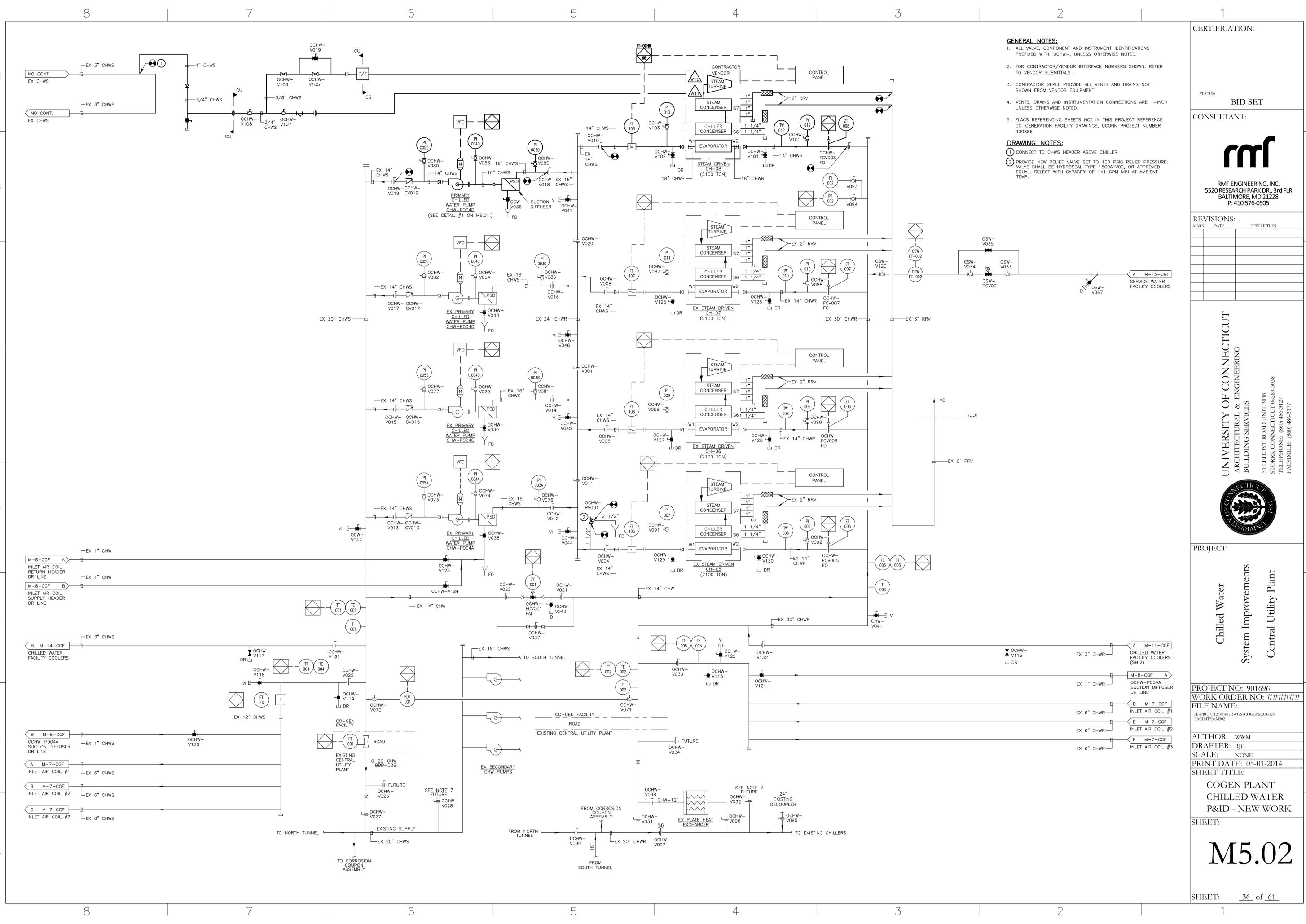
PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M501

AUTHOR: WWM  
 DRAFTER: RIC  
 SCALE: NONE  
 PRINT DATE: 05-01-2014

SHEET TITLE:  
 OVERALL CHILLED WATER SCHEMATIC COGEN & CUP - NEW WORK

SHEET:  
**M5.01**

SHEET: 35 of 61



- GENERAL NOTES:**
1. ALL VALVE, COMPONENT AND INSTRUMENT IDENTIFICATIONS PREFIXED WITH, OCHW--, UNLESS OTHERWISE NOTED.
  2. FOR CONTRACTOR/VENDOR INTERFACE NUMBERS SHOWN, REFER TO VENDOR SUBMITTALS.
  3. CONTRACTOR SHALL PROVIDE ALL VENTS AND DRAINS NOT SHOWN FROM VENDOR EQUIPMENT.
  4. VENTS, DRAINS AND INSTRUMENTATION CONNECTIONS ARE 1-INCH UNLESS OTHERWISE NOTED.
  5. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.
- DRAWING NOTES:**
1. CONNECT TO CHWS HEADER ABOVE CHILLER.
  2. PROVIDE NEW RELIEF VALVE SET TO 100 PSIG RELIEF PRESSURE. VALVE SHALL BE HYDROSEAL TYPE 15G9A1V00, OR APPROVED EQUAL. SELECT WITH CAPACITY OF 141 GPM MIN AT AMBIENT TEMP.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

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5520 RESEARCH PARK DR., 3rd FLR  
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P: 410.576-0505

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FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\11283A\DWG\COGEN\COGEN\FACILITY\M502

AUTHOR: WWM  
DRAFTER: RJC  
SCALE: NONE  
PRINT DATE: 05-01-2014  
SHEET TITLE:

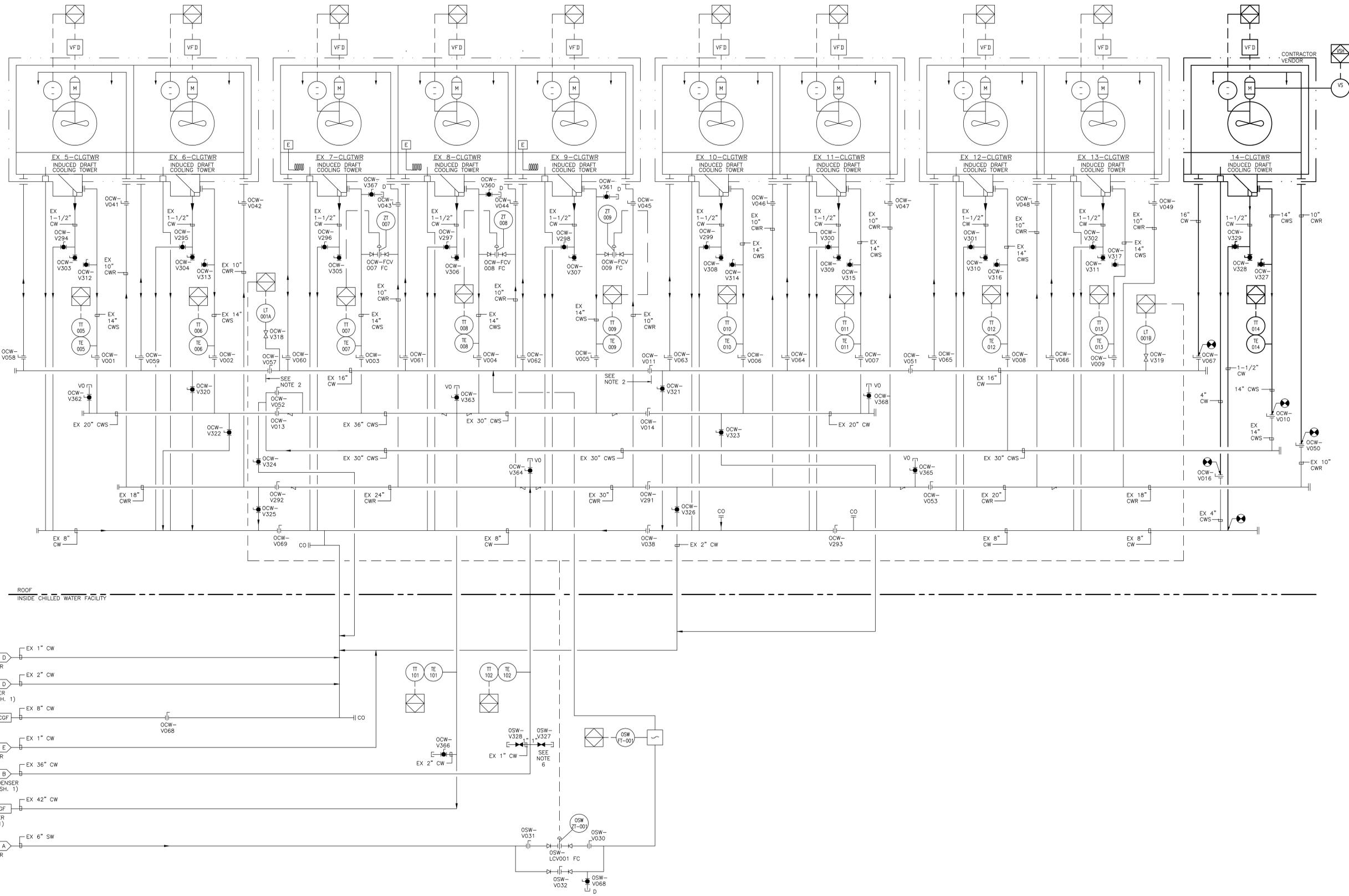
COGEN PLANT  
CHILLED WATER  
P&ID - NEW WORK

SHEET:

**M5.02**

SHEET: 36 of 61

- GENERAL NOTES:**
1. ALL VALVE AND INSTRUMENT IDENTIFICATIONS PREFIXED WITH, OCV- UNLESS OTHERWISE NOTED.
  2. VENTS, DRAINS AND INSTRUMENTATION CONNECTIONS ARE 1-INCH - UNLESS OTHERWISE NOTED.
  3. COOLING TOWERS HAVE STAINLESS STEEL BASINS. THEREFORE ALL CWS TO SS INTERFACES (16" EQUALIZATION, 14" SUMP OUTLET, 10" INLET, 4" OVERFLOW/DRAIN AND 1.5" SUMP DRAIN) WILL REQUIRE FLANGE INSULATING KITS OR DI-ELECTRIC UNIONS, AND SS TRANSITION PIECES AS REQUIRED.
  4. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M503

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

SHEET TITLE:

COGEN PLANT  
CONDENSER WATER  
P&ID - NEW WORK

SHEET:

**M5.03**

SHEET: 37 of 61

- GENERAL NOTES:**
1. ALL VALVE AND INSTRUMENT IDENTIFICATIONS PREFIXED WITH OCW-, UNLESS OTHERWISE NOTED.
  2. FOR CONTRACTOR/VENDOR INTERFACE NUMBERS SHOWN, REFER TO VENDOR SUBMITTALS.
  3. CONTRACTOR SHALL PROVIDE ALL VENTS AND DRAINS NOT SHOWN FROM VENDOR EQUIPMENT.
  4. VENTS, DRAINS AND INSTRUMENTATION CONNECTIONS ARE 1-INCH UNLESS OTHERWISE NOTED.
  5. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONWV PROJECT NUMBER 900866.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



REVISIONS:

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 FACSIMILE: (860) 486-3177



PROJECT:

**Chilled Water  
 System Improvements  
 Central Utility Plant**

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:  
 H:\PROJ\112838\DWG\COGEN\COGEN FACILITY\M504

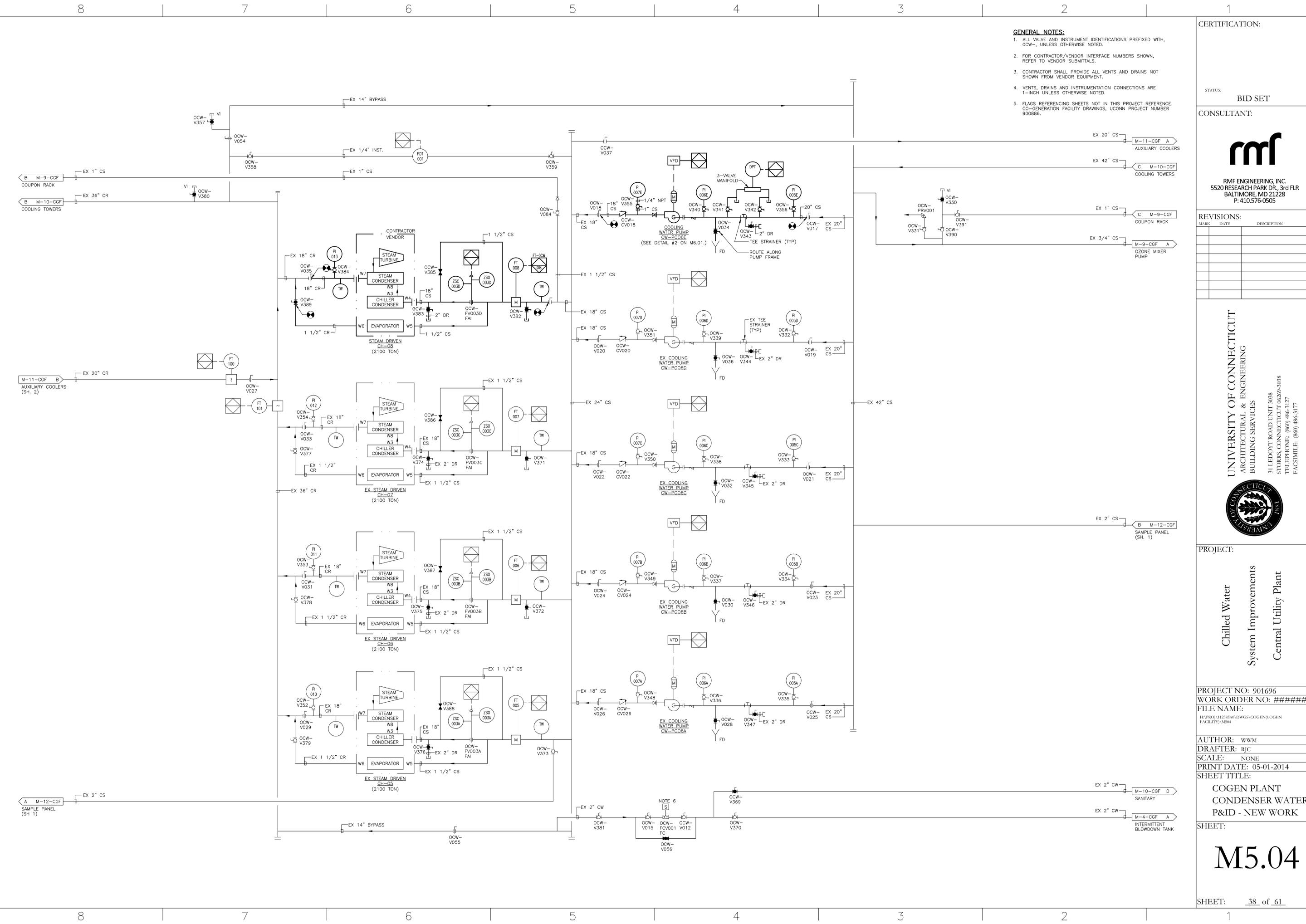
AUTHOR: WWM  
 DRAFTER: RIC  
 SCALE: NONE  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:

**COGEN PLANT  
 CONDENSER WATER  
 P&ID - NEW WORK**

SHEET:

**M5.04**

SHEET: 38 of 61



**GENERAL NOTES:**

1. ALL VALVE AND INSTRUMENT IDENTIFICATIONS PREFIXED WITH, 0125-, UNLESS OTHERWISE NOTED.
2. FOR CONTRACTOR/VENDOR INTERFACE NUMBERS SHOWN, REFER TO VENDOR SUBMITTALS. DRAWING THE FOLLOWING:
  - SB = STEAM CONDENSER RELIEF VALVE WATER OVERFLOW
  - SC = VACUUM PUMP VENT
  - SC1 = VACUUM PUMP VENT
  - SD = GLAND LEAKOFF
3. CONTRACTOR SHALL PROVIDE ALL VENTS AND DRAINS NOT SHOWN FROM VENDOR EQUIPMENT.
4. VENTS, DRAINS AND INSTRUMENTATION CONNECTIONS ARE 1-INCH UNLESS OTHERWISE NOTED.
5. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**



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BUILDING SERVICES  
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TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



**PROJECT:**

**Chilled Water  
System Improvements  
Central Utility Plant**

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:  
H:\PROJ\112838\DWG\COGEN\COGEN FACILITY\M505

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

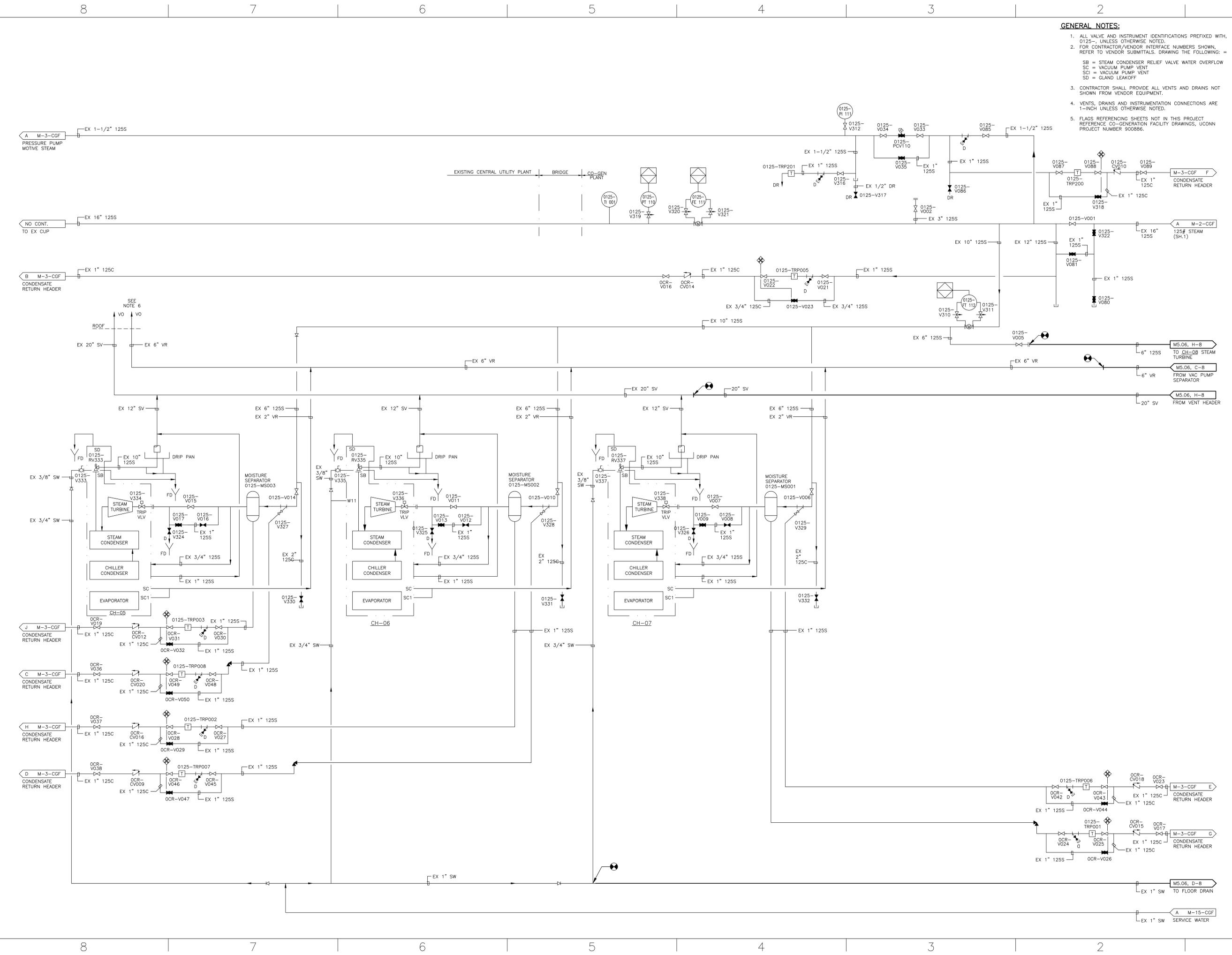
SHEET TITLE:

**OVERALL STEAM  
SCHEMATIC COGEN  
& CUP - NEW WORK**

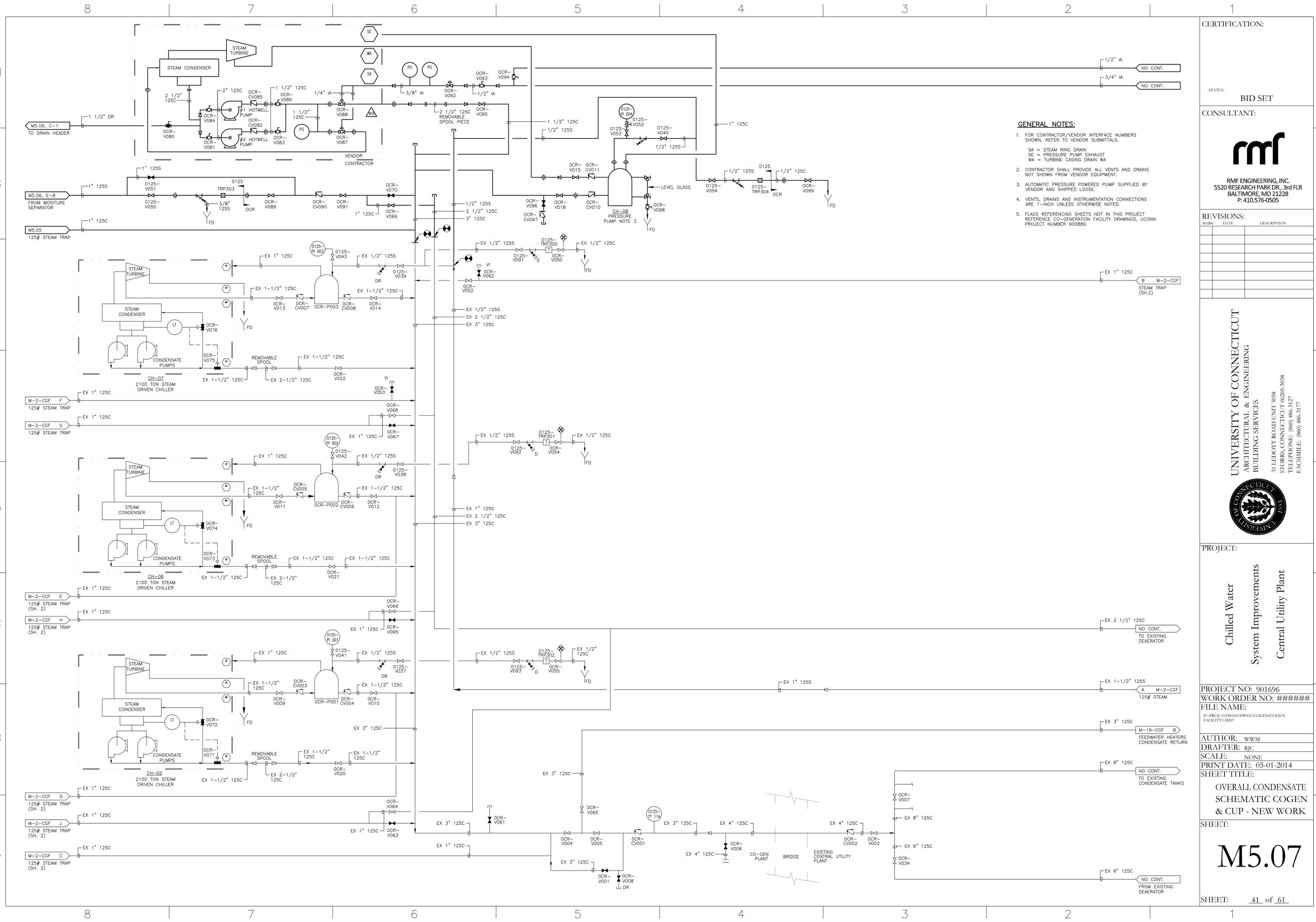
SHEET:

**M5.05**

SHEET: 39 of 61







**GENERAL NOTES:**

- FOR CONTRACTOR/VENDOR INTERFACE NUMBERS SHOWN, REFER TO VENDOR SUBMITTALS.  
SA = STEAM RING DRAIN  
SE = PRESSURE PUMP EXHAUST  
WA = TURBINE CASING DRAIN WA
- CONTRACTOR SHALL PROVIDE ALL VENTS AND DRAINS NOT SHOWN FROM VENDOR EQUIPMENT.
- AUTOMATIC PRESSURE POWERED PUMP SUPPLIED BY VENDOR AND SHIPPED LOOSE.
- VENTS, DRAINS AND INSTRUMENTATION CONNECTIONS ARE 1-INCH UNLESS OTHERWISE NOTED.
- FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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REVISIONS:

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UNIVERSITY OF CONNECTICUT  
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STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3177  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M507

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

SHEET TITLE:

OVERALL CONDENSATE SCHEMATIC COGEN & CUP - NEW WORK

SHEET:

**M5.07**

SHEET: 41 of 61

**GENERAL NOTES:**

1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.

**DRAWING NOTES:**

① COORDINATE REFRIGERANT TERMINATION CONNECTION TYPE AND SIZE WITH UCONN UTILITIES TO MATCH EXISTING FLEXIBLE HOSE ENDS.

**CERTIFICATION:**

STATUS: **BID SET**

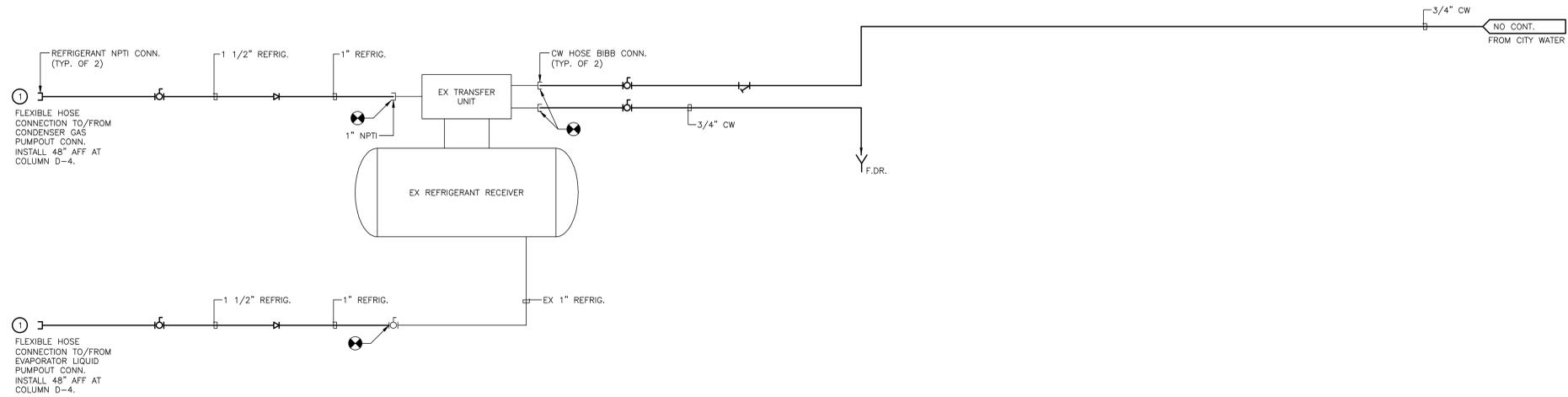
**CONSULTANT:**



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**REVISIONS:**

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FACSIMILE: (860) 486-3177



**PROJECT:**

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M508

AUTHOR: WWM

DRAFTER: WMB

SCALE: NONE

PRINT DATE: 05-01-2014

SHEET TITLE:

REFRIGERANT STORAGE/  
TRANSFER SYSTEM -  
NEW WORK

**SHEET:**

**M5.08**

SHEET: 42 of 61

**GENERAL NOTES:**

1. FLAGS REFERENCING SHEETS NOT IN THIS PROJECT REFERENCE CO-GENERATION FACILITY DRAWINGS, UCONN PROJECT NUMBER 900886.

**DRAWING NOTES:**

- ① PROVIDE BLADDER MONITOR ON NEW AND EXISTING EXPANSION TANKS. SUPPLY POWER TO BLADDER MONITORING SYSTEM DEVICES FROM NEAREST 120 VAC PANEL.
- ② CONTRACTOR SHALL PROVIDE INSULATION TO ANY NEWLY INSTALLED OR RELOCATED PIPE TO MATCH EXISTING PIPE CONDITIONS.
- ③ DIAPHRAGM OPERATED PRESSURE REDUCING VALVE SELECTION AND SET POINT SHALL BE PER SPECIFICATION 232116.

CERTIFICATION:

STATUS:

**BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\M509

AUTHOR: WWM

DRAFTER: RIC

SCALE: NONE

PRINT DATE: 05-01-2014

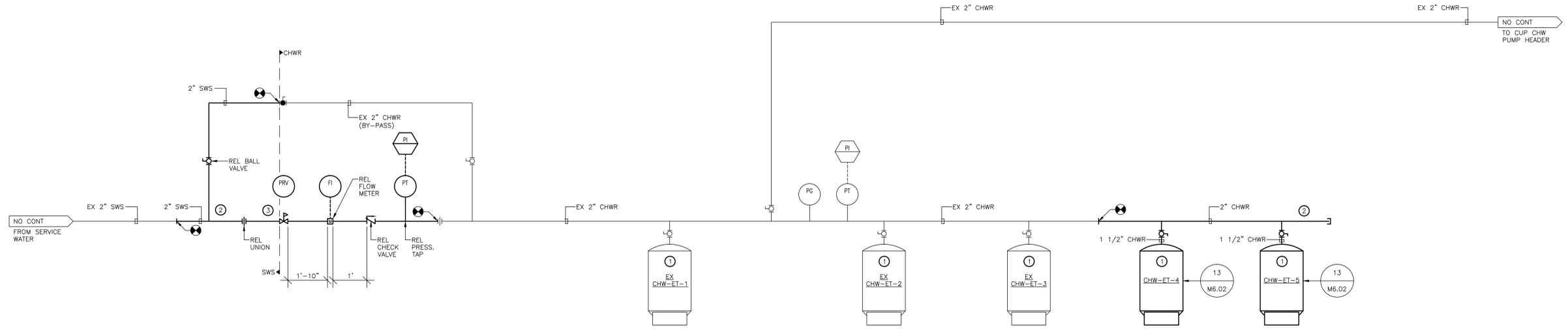
SHEET TITLE:

MAKE-UP SYSTEM AND  
EXPANSION TANKS  
- NEW WORK

SHEET:

**M5.09**

SHEET: 43 of 61



8 7 6 5 4 3 2 1

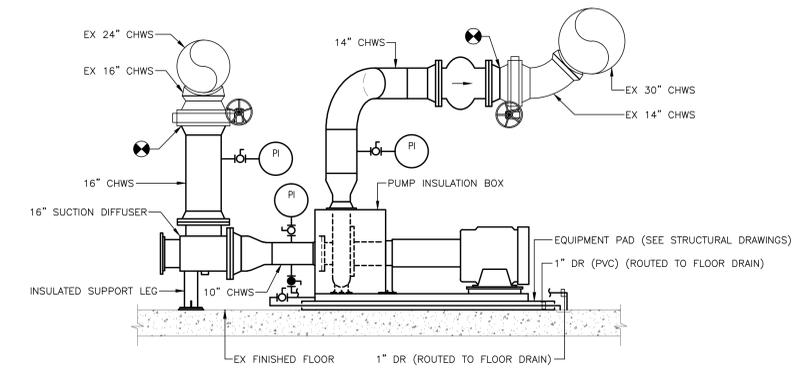
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- NOTES:**
- POWER TO PUMP NOT SHOWN.
  - PIPING INSULATION NOT SHOWN.

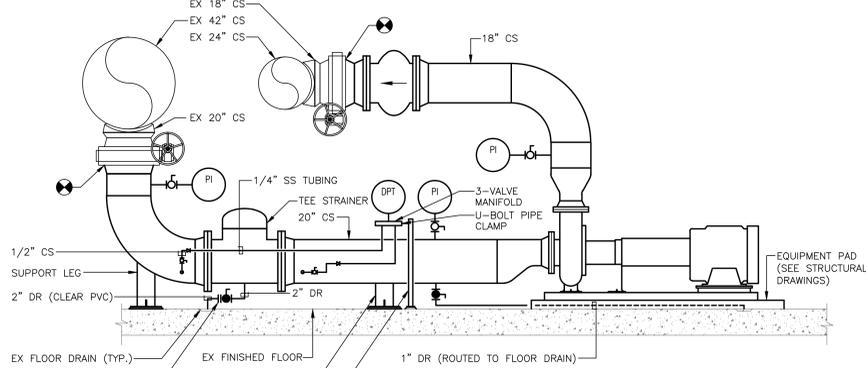


(SECTION LOOKING NORTH)

CHILLED WATER PUMP DETAIL-CHW-P004D

SCALE: 3/8"=1'-0" 1

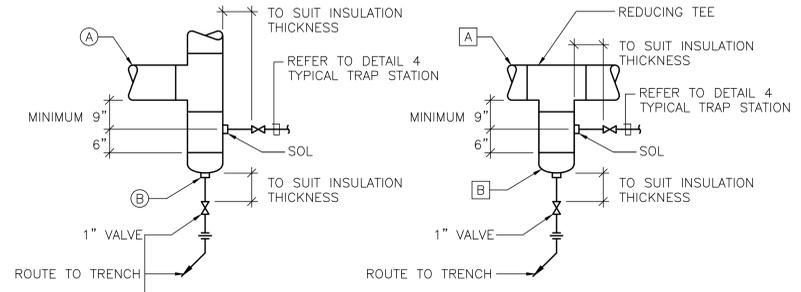
- NOTES:**
- POWER TO PUMP AND DPT NOT SHOWN.
  - PROVIDE CLEAR PVC PIPING FROM TEE STRAINER DRAIN QUICK DISCONNECT TO FLOOR DRAIN.
  - INSULATION NOT SHOWN.



(SECTION LOOKING NORTH)

CONDENSER WATER PUMP DETAIL-CW-P006E

SCALE: 3/8"=1'-0" 2



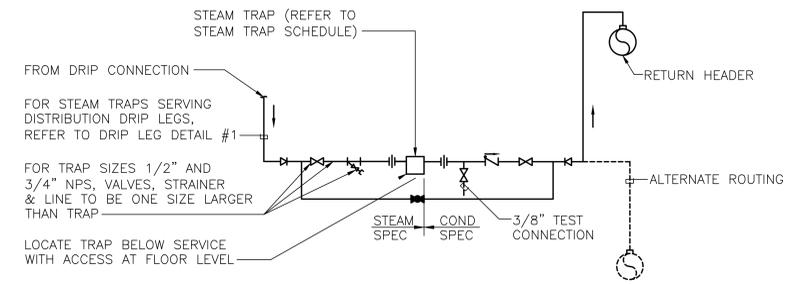
(A) LINE SIZE	(B) DRIP POCKET
2" & SMALLER	FULL SIZE PIPE W/ REDUCING COUPLING
2 1/2" - LARGER	FULL SIZE PIPE CAP W/ 1" HALF CPLG

(A) LINE SIZE	(B) DRIP POCKET
4" AND LESS	FULL SIZE
6" - 8"	4"
10" - 12"	6"
14" - 16"	8"
18" - 20"	10"
24"	12"

- NOTES:**
- ALL PIPING AND VALVE COMPONENTS SHOWN TO MATCH SPECIFICATIONS FOR THE SPECIFIC STEAM PIPING SYSTEM.

DETAIL - STEAM DRIP LEG

SCALE: NONE 3

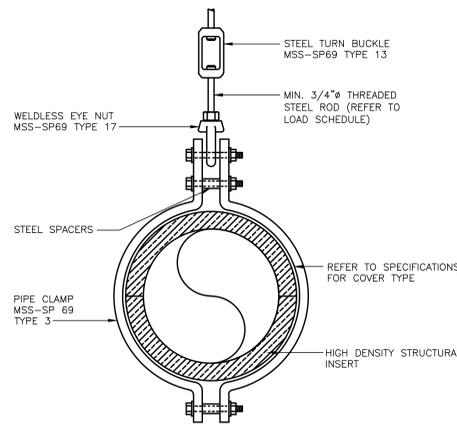


- NOTES:**
- ALL STRAINERS SHALL BE PROVIDED WITH A BLOW DOWN VALVE WITH PIPE NIPPLE AND SCREWED PIPE CAP.

DETAIL - STEAM TRAP STATION

SCALE: NONE 4

PIPE SIZE	MAX. SPACING	ROD SIZE
6"	17'	3/4"
8"	19'	3/4"
10"	22'	7/8"
12"	23'	7/8"
14"	25'	1"
16"	27'	1"
18"	28'	1"
20"	30'	1 1/4"

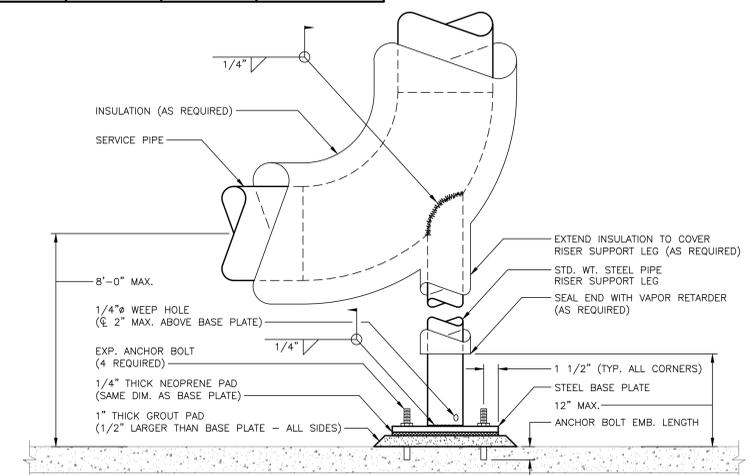


DETAIL - PIPE HANGERS (6" OR LARGER)

SCALE: NONE 5

SERVICE PIPE SIZE	SUPPORT LEG	BASE PLATE	ANCHOR BOLTS
4" - 8"	3"	8"x8"x3/8"	1/2", 3 1/2" EMB.
10" - 12"	4"	8"x8"x3/8"	5/8", 3 1/2" EMB.
12" - 18"	6"	10"x10"x3/8"	5/8", 3 1/2" EMB.
20" - 24"	8"	14"x14"x3/8"	3/4", 3 1/2" EMB.
30" - 36"	12"	18"x18"x1/2"	3/4", 3 1/2" EMB.

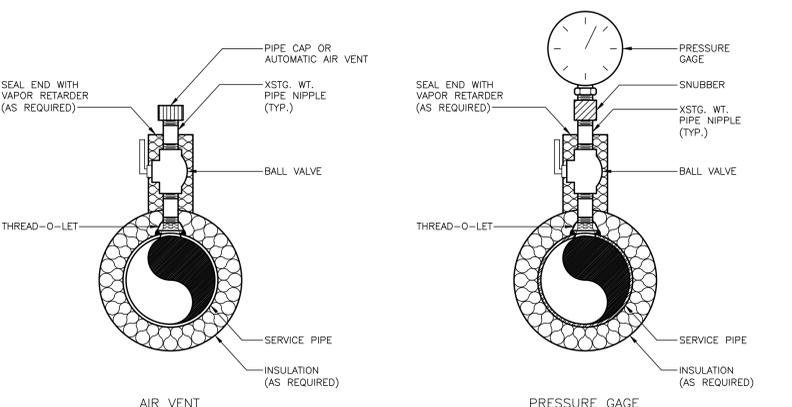
- NOTES:**
- INSTALL ANCHOR BOLTS PER MANUFACTURER'S INSTRUCTIONS. FOR EXTERIOR SERVICE PIPE, ALL ANCHOR BOLTS SHALL BE HOT-DIPPED GALVANIZED PER ASTM A123.



DETAIL - PIPE RISER SUPPORT

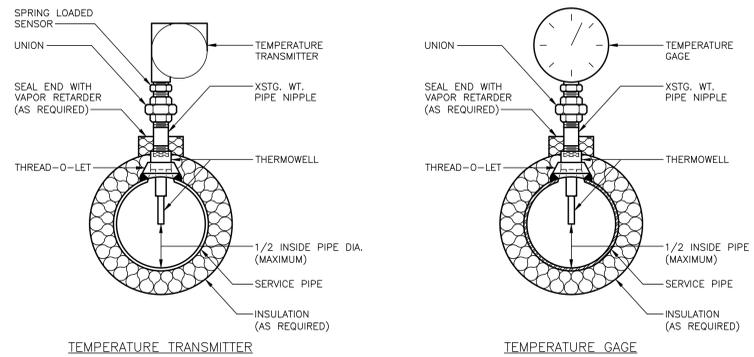
SCALE: NONE 6

SERVICE PIPE SIZE	VENT SIZE
1 1/2" & SMALLER	1/2"
2" - 8"	3/4"
10" & LARGER	1"



DETAIL - AIR VENT & PRESSURE GAGE

SCALE: NONE 7

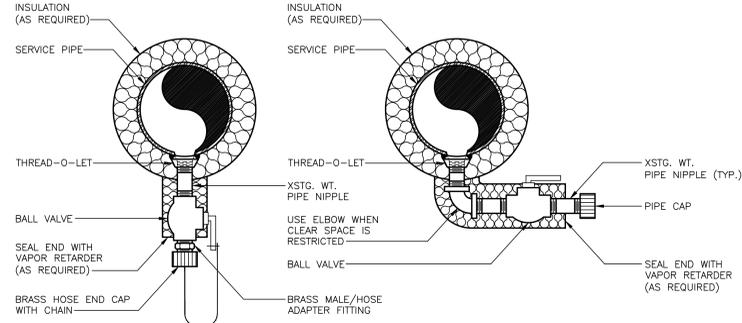


DETAIL - TEMPERATURE TRANSMITTER / GAGE

SCALE: NONE 8

- NOTES:**
- FOR DRAIN SIZES 3/4" AND SMALLER PROVIDE BRASS MALE/HOSE ADAPTER FITTING AND BRASS HOSE END CAP WITH CHAIN DOWNSTREAM OF BALL VALVE.
  - FOR DRAIN SIZES 1" AND LARGER PROVIDE EXTRA STRONG WEIGHT PIPE NIPPLE AND PIPE CAP DOWNSTREAM OF BALL VALVE.

SERVICE PIPE SIZE	DRAIN SIZE
1 1/2" & SMALLER	1/2"
2" - 8"	3/4"
10" - 20"	1"
24" & LARGER	2"



DETAIL - SERVICE PIPE DRAIN

SCALE: NONE 9

CERTIFICATION:

STATUS: BID SET

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES



31 LEDDY ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\112838\DWG\COGEN\COGEN FACILITY\M601

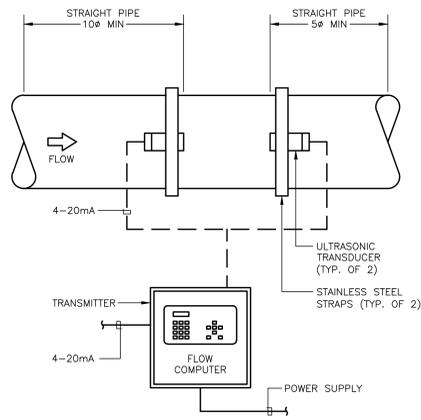
AUTHOR: WWM  
DRAFTER: RJC  
SCALE: AS NOTED  
PRINT DATE: 05-01-2014  
SHEET TITLE:

MECHANICAL  
DETAILS

SHEET:

M6.01

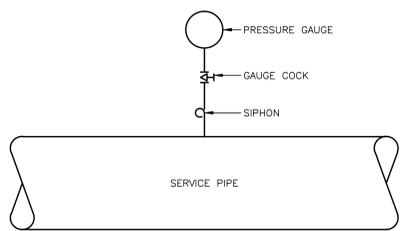
SHEET: 44 of 61



- NOTES**
1. PROVIDE TEN PIPE DIAMETERS OF STRAIGHT PIPE LENGTH UPSTREAM FROM THE ULTRASONIC TRANSDUCERS AND FIVE PIPE DIAMETERS OF STRAIGHT PIPE LENGTH DOWNSTREAM FROM THE ULTRASONIC TRANSDUCERS.
  2. PRIOR TO INSTALLATION OF THE ULTRASONIC TRANSDUCER THE PIPE SHALL BE CLEANED TO THE BARE METAL. REMOVE ALL PAINT, RUST, SCALE, ETC.
  3. PROVIDE WITH REMOVABLE INSULATION AT TRANSDUCER LOCATIONS ON CHW.

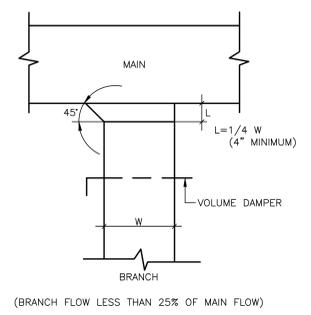
DETAIL - ULTRASONIC FLOWMETER

SCALE: NONE 10



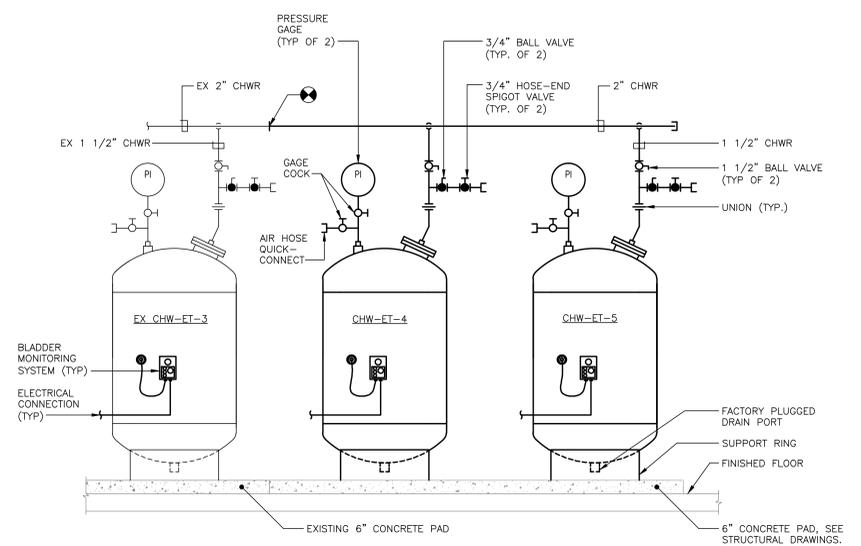
DETAIL - STEAM PRESSURE GAUGE

SCALE: NONE 11



DETAIL - BRANCH TAKE-OFFS

SCALE: NONE 12



DETAIL - EXPANSION TANK CONNECTION

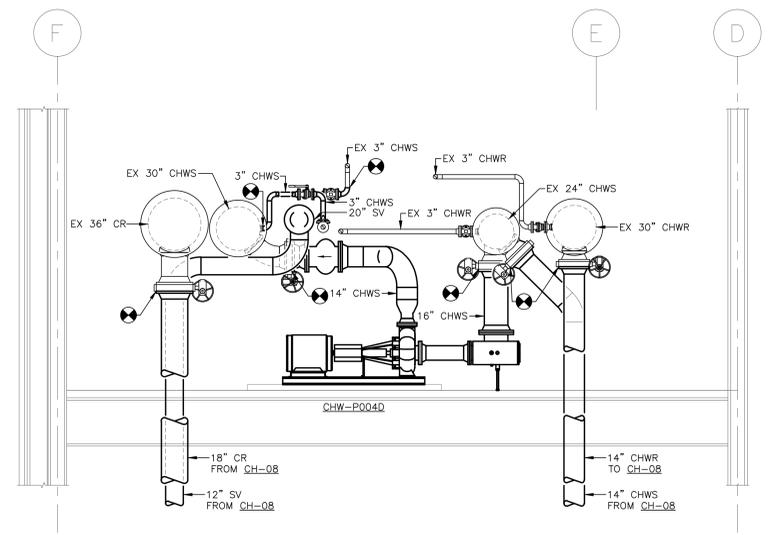
SCALE: NONE 13



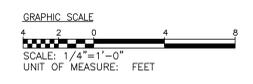
SCALE: NONE 14



SCALE: NONE 15



SECOND FLOOR SECTION "A" - LOOKING SOUTH



CERTIFICATION:

STATUS: BID SET

CONSULTANT:



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5520 RESEARCH PARK DR., 3rd FLR  
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P: 410.576-0505

REVISIONS:

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PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M602

AUTHOR: WWM

DRAFTER: RJC

SCALE: AS NOTED

PRINT DATE: 05-01-2014

SHEET TITLE:

MECHANICAL  
DETAILS

SHEET:

M6.02

SHEET: 45 of 61

CERTIFICATION:

STATUS:

BID SET

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

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PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\11283A\DWGS\COGEN\COGEN FACILITY\M701

AUTHOR: WWM  
DRAFTER: RIC  
SCALE: NONE  
PRINT DATE: 05-01-2014  
SHEET TITLE:

MECHANICAL  
SCHEDULES

SHEET:

M7.01

SHEET: 46 of 61

COOLING TOWER SCHEDULE

DESIGNATION	NOMINAL CAPACITY (TON)	FLOW RATE (GPM)	AMBIENT WET BULB TEMP (°F)	E.W.T. (°F)	L.W.T. (°F)	FAN MOTOR HP	ELECTRICAL DATA			NO. OF CELLS	MAX DRIFT LOSS	BASIN HEATING	CONSTRUCTION TYPE	TOWER TYPE	BASIS OF DESIGN	ACCESSORIES	REMARKS	WEIGHT (LBS.)
							VOLTS	PHASE	HERTZ									
14-CLGTWR		3000	78	101.9	85	125	460	3	60	1	0.005	NONE	GALV UPPER, SS COLD WATER BASIN	PACKAGED, INDUCED DRAFT CROSSFLOW	MARLEY NC 8312		VFC	

NOTES:  
1. TOWER SHALL FIT ON EXISTING STEEL

PUMP SCHEDULE

DESIGNATION	SYSTEM	PUMP TYPE	SERVICE	MOUNTING	FLUID TEMP. (°F)	CAPACITY (GPM)	TOTAL HEAD (FT.)	MIN. EFFICIENCY (%)	POWER				BRAKE HORSEPOWER (BHP)	MAX. RPM	SUCTION X DISCH. SIZE (IN.)	BASIS OF DESIGN	REMARKS	WEIGHT (LBS)
									VOLTS	PHASE	HERTZ	MOTOR (HP)						
CHW-P0004D	CHW	END SUCTION	CHILLED WATER	BASE	58	4600	170	95.4	460	3	60	250	240.5	1800	8X10-16	GOULDS MODEL 3180 L	VFC	5300
CW-P006E	CW	END SUCTION	CONDENSER WATER	BASE	85	6900	96	94.5	460	3	60	250	195.9	1200	12X14-19	GOULDS MODEL 3180 L		6600

NOTES:  
1. PUMP ROTATIONS SHALL BE VERIFIED BY CONTRACTOR.

CHILLER SCHEDULE

DESIGNATION	NOMINAL CAPACITY (TON)	TYPE	REFRIGERANT	EVAPORATOR						CONDENSER						STEAM CONDENSER			STEAM TURBINE		ELECTRICAL DATA			MAX SOUND RATING (dBA)	BASIS OF DESIGN	ACCESSORIES	REMARKS	WEIGHT (LBS.)		
				E.W.T. (°F)	L.W.T. (°F)	FLOW (GPM)	MAX WATER PRESS. DROP (FT)	PASSES	FOULING FACTOR	E.W.T. (°F)	L.W.T. (°F)	FLOW (GPM)	MAX WATER PRESS. DROP (FT)	PASSES	FOULING FACTOR	E.W.T. (°F)	L.W.T. (°F)	FLOW (GPM)	MAX WATER PRESS. DROP (FT)	PASSES	INLET PRESS. (PSIG)	INLET TEMP. (°F)	VOLTS						PHASE	HERTZ
CH-08	2100	PACKAGED-CENTRIFUGAL-STEAM DRIVEN	R-134A	54	42	4200	18.4	2	0.0001	85	95	6300	35.90	2	0.00025	94.34	100.16	6300	12.17	1	125	352.9	460	3	60	85	YORK YSTWFDVJ4	ALLEN-BRADLEY PLC		

NOTES:  
1.

SPRING HANGER SCHEDULE

DESIGNATION	STRESS ANALYSIS PROGRAM NODE NO.	DWG NO.	PIPE SIZE AND SERVICE	ANVIL FIGURE NO.	ANVIL SPRING SIZE	TYPE	SPRING RATE (LB/IN)	LOAD		DEFLECTION (IN)	REMARKS
								HOT (LBF)	COLD (LBF)		
SH-1	1130	M2.02	6" 125S	E82	8	B	300	859	850	0.03	TOP OF ELBOW
SH-2	1260	M2.01	6" 125S	E82	7	B	224	745	650	0.426	

NOTES:  
1. THE ANVIL FIGURE NUMBER AND SIZE HAVE BEEN PROVIDED AS A BASIS OF DESIGN FOR THE SPRING HANGERS.  
2. POSITIVE DEFLECTION VALUES DEPICT VERTICAL MOTION UPWARDS FROM COLD TO HOT POSITION. NEGATIVE VALUES DEPICT DOWNWARD MOTION.



**GENERAL NOTES:**

1. EXACT LOCATION OF CONDUIT AND CONDUCTOR RUN SHALL BE FIELD COORDINATED WITH EXISTING CONDITIONS.
2. ETHERNET AND RS-485 COMMUNICATION CABLES SHALL BE INSTALLED IN RMC, FASTENED UNDER EXISTING CABLE TRAYS PER MANUFACTURER RECOMMENDATION. ALL OTHER INSTRUMENTATION AND CONTROL CABLES SHALL BE INSTALLED IN EXISTING CABLE TRAYS AND DROPPED TO THEIR TERMINATION POINTS IN RMC.
3. REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.
4. FOR INSTALLATION OF ALL NEW BREAKERS, COORDINATE SHUTDOWN AND INSPECTION WITH THE PLANT AND THE OFFICE OF FIRE MARSHAL & BUILDING INSPECTOR (OFMBI).

**DRAWING NOTES:**

- ① NEW 1" RMC CONDUIT SHALL BE FASTENED TO THE BOTTOM OF THE EXISTING CABLE TRAY SYSTEM FROM MCC-CTG3 TO NEW STEAM TURBINE DRIVE CHILLER SKID #8.
- ② EXISTING MECHANICALLY INTERLOCKING 480V RECEPTACLE FOR REFRIGERANT STORAGE TANK COMPRESSOR RECEPTACLE SHALL BE RELOCATED ALONG WITH THE REFRIGERANT STORAGE TANK COMPRESSOR TO THE NEW STRUCTURAL PLATFORM NORTH OF STEAM TURBINE DRIVEN CHILLER CH-08. REFER TO DRAWING 52.01 FOR GENERAL LOCATION OF THE RELOCATED RECEPTACLE.
- ③ CONTRACTOR TO MATCH NAMING CONVENTION OF EXISTING METERS.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3RD FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES



31 LEDDY ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283\A\DWGS\COGEN\COGEN FACILITY\E202A

AUTHOR: KFK

DRAFTER: PRC

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

PRINT DATE: 05-01-2014

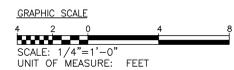
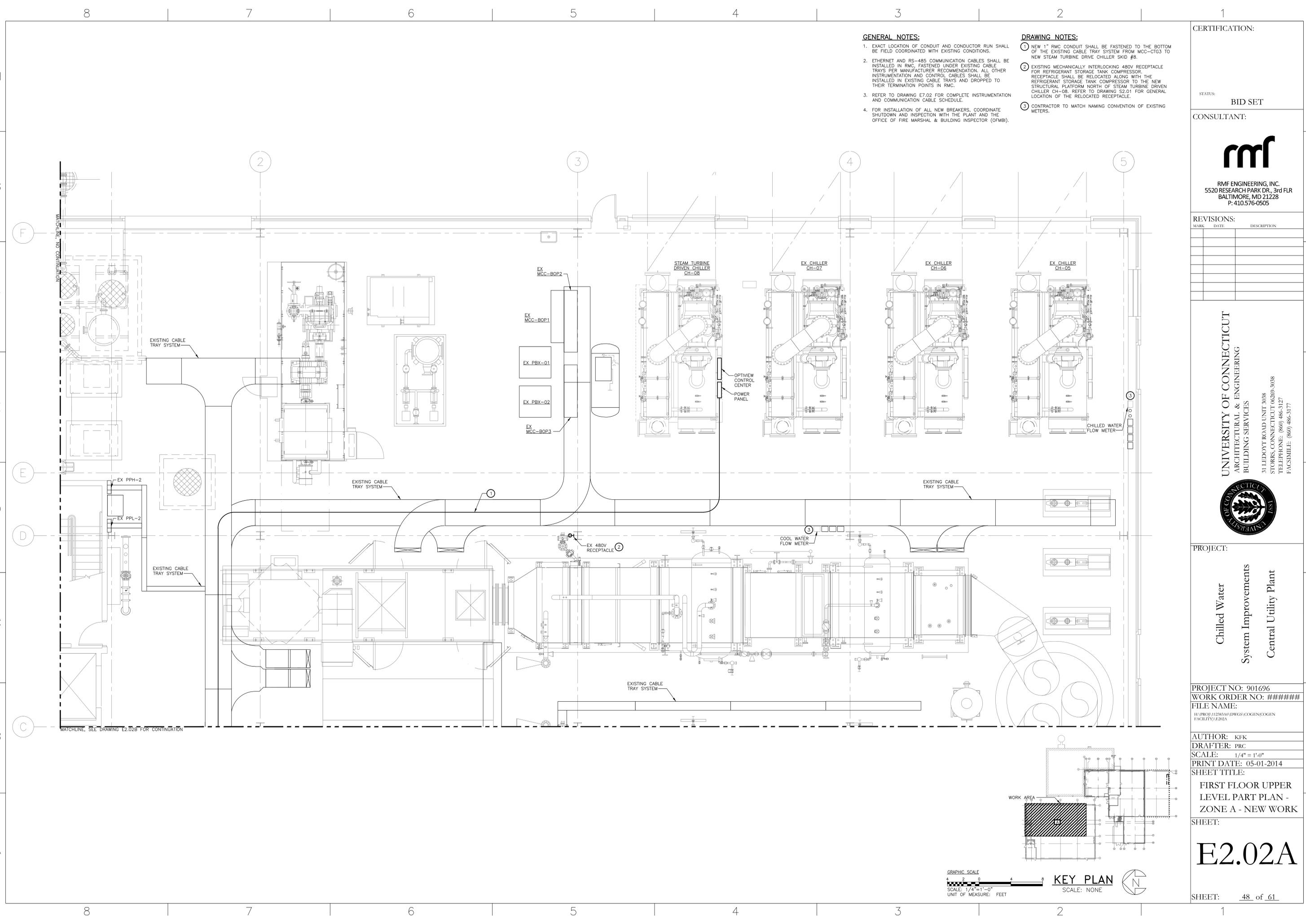
SHEET TITLE:

FIRST FLOOR UPPER  
LEVEL PART PLAN -  
ZONE A - NEW WORK

SHEET:

**E2.02A**

SHEET: 48 of 61

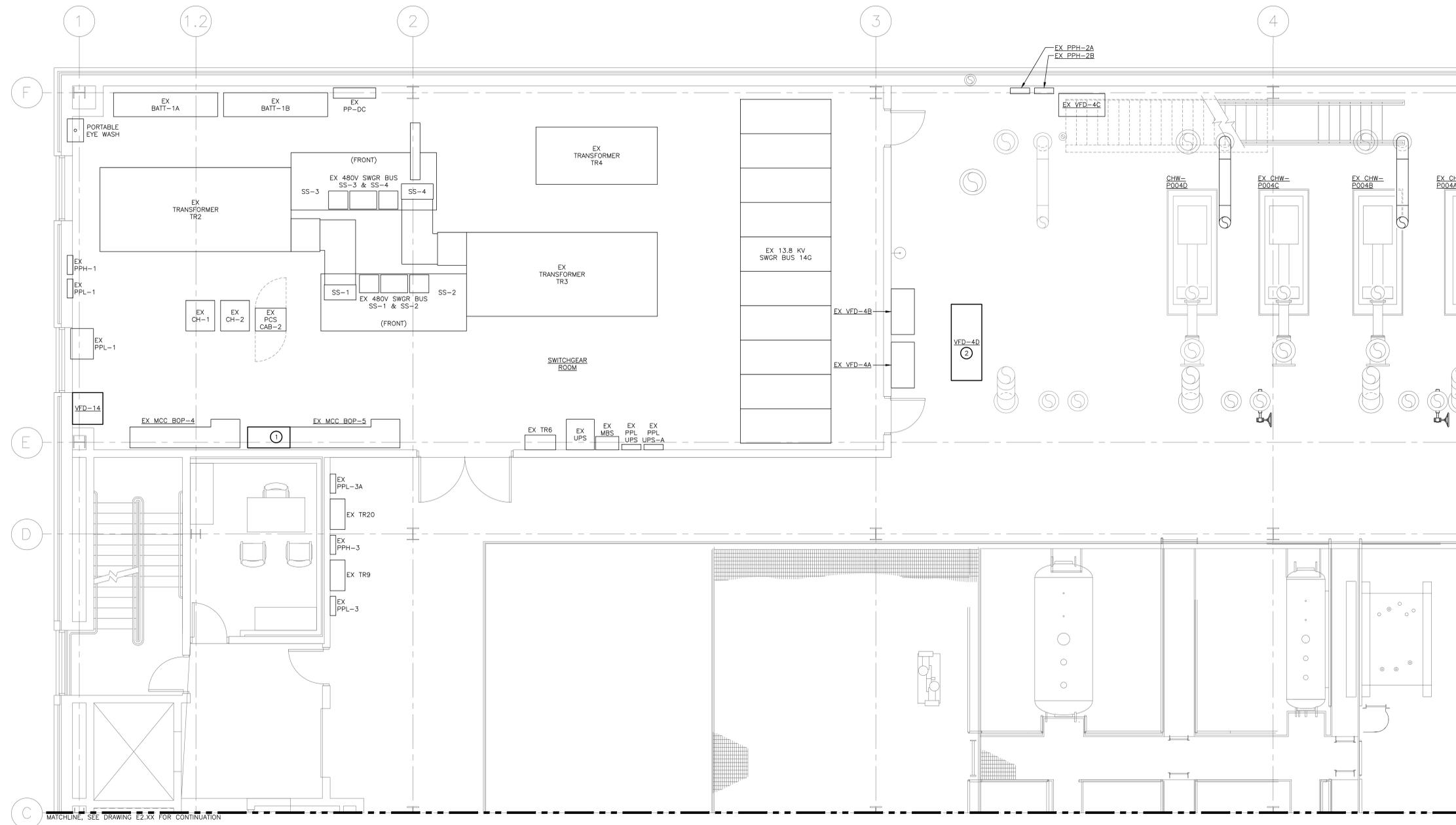


**KEY PLAN**  
SCALE: NONE





8 7 6 5 4 3 2 1



**GENERAL NOTES:**

- COORDINATE ALL ELECTRICAL SHUTDOWNS WITH THE FACILITY PRIOR TO DE-ENERGIZING.
- REFER TO DRAWING E7.01 FOR MCC BOP-4 AND MCC BOP-5 EQUIPMENT DETAILS.
- REFER TO DRAWINGS E2.04A FOR ALL NEW EQUIPMENT CONDUIT RUNS.
- REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.
- FOR INSTALLATION OF ALL NEW BREAKERS, COORDINATE SHUTDOWN AND INSPECTION WITH THE PLANT AND THE OFFICE OF FIRE MARSHAL & BUILDING INSPECTOR (OFMBI).

**DRAWING NOTES:**

- INSTALL ADDITIONAL 2 SECTIONS TO EX MCC BOP-5 FOR COOLING WATER PUMP "E" SOFT STARTER AND OVERCURRENT PROTECTION DEVICE.
- RELOCATE EXISTING AUXILIARY FIRE SYSTEM DRAIN PRIOR TO VFD-4D INSTALLATION.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



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5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112835A\DWGS\COGEN\COGEN FACILITY\E203A

AUTHOR: KFK

DRAFTER: PRC

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

PRINT DATE: 05-01-2014

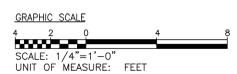
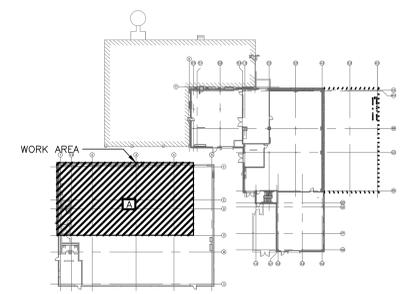
SHEET TITLE:

2ND FLOOR LOWER  
LEVEL PART PLAN -  
ZONE A - NEW WORK

SHEET:

**E2.03A**

SHEET: 50 of 61



KEY PLAN

SCALE: NONE

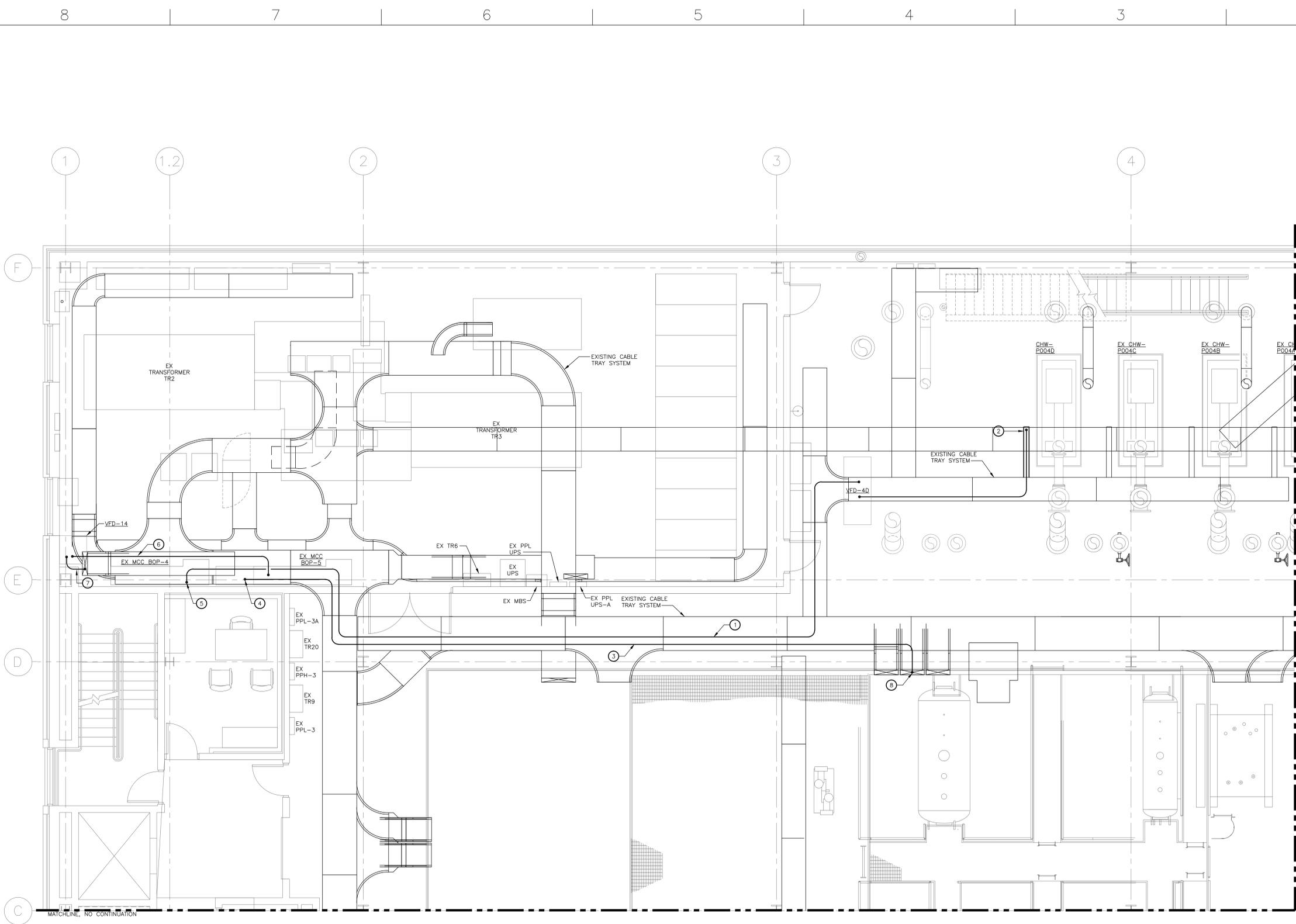


MATCHLINE, SEE DRAWING E2.XX FOR CONTINUATION

MATCHLINE, NO CONTINUATION

H  
G  
F  
E  
D  
C  
B  
A

8 7 6 5 4 3 2 1



- GENERAL NOTES:**
- EXACT LOCATION OF CONDUIT AND CONDUCTOR RUN SHALL BE FIELD COORDINATED WITH EXISTING CONDITIONS.
  - FIRESTOPPING SHALL BE INSTALLED AT ALL FLOOR, WALL, AND CEILING PENETRATIONS FROM THE SWITCHGEAR ROOM.
  - ETHERNET AND RS-485 COMMUNICATION CABLES SHALL BE INSTALLED IN RMC, FASTENED UNDER EXISTING CABLE TRAYS PER MANUFACTURER RECOMMENDATION. ALL OTHER INSTRUMENTATION AND CONTROL CABLES SHALL BE INSTALLED IN EXISTING CABLE TRAYS AND DROPPED TO THEIR TERMINATION POINTS IN RMC.
  - REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.
  - FOR INSTALLATION OF ALL NEW BREAKERS, COORDINATE SHUTDOWN AND INSPECTION WITH THE PLANT AND THE OFFICE OF FIRE MARSHAL & BUILDING INSPECTOR (OFMBI).

- DRAWING NOTES:**
- ROUTE BRANCH CIRCUIT FROM MCC BOP-4 TO VFD-40 THROUGH EXISTING CABLE TRAY SYSTEM.
  - INSTALL 6" CABLE TRAY TO CHW-P004D, CONNECT TO EXISTING CABLE TRAY SYSTEMS AND SUPPORT PER THE MANUFACTURER'S RECOMMENDATION.
  - ROUTE BRANCH CIRCUIT FROM MCC BOP-5 TO NEW COOLING WATER PUMP LOCATED ON THE MEZZANINE LEVEL THROUGH EXISTING CABLE TRAY SYSTEM.
  - ROUTE BRANCH CIRCUIT THROUGH EXISTING CABLE TRAY DOWN TO NEW SECTION OF EX MCC BOP-5.
  - ROUTE BRANCH CIRCUIT THROUGH EXISTING CABLE TRAY DOWN TO EX MCC BOP-4.
  - ROUTE BRANCH CIRCUIT FROM MCC BOP-5 TO VFD-14 THROUGH EXISTING CABLE TRAY SYSTEM.
  - ROUTE BRANCH CIRCUIT FROM VFD-14 TO COOLING TOWER FAN 14 THROUGH EXISTING VERTICAL CABLE TRAY TO MEZZANINE LEVEL.
  - EXISTING VERTICAL CABLE TRAY TO MEZZANINE LEVEL.

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

RMF ENGINEERING, INC.  
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BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

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PROJECT:

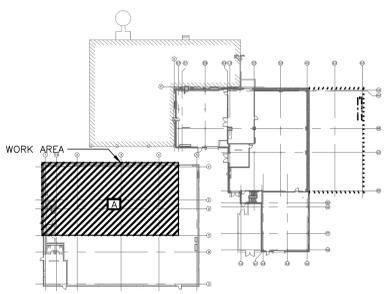
Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\E204A

AUTHOR: KFK  
DRAFTER: PRC  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
2ND FLOOR UPPER  
LEVEL PART PLAN -  
ZONE A - NEW WORK

SHEET:  
**E2.04A**

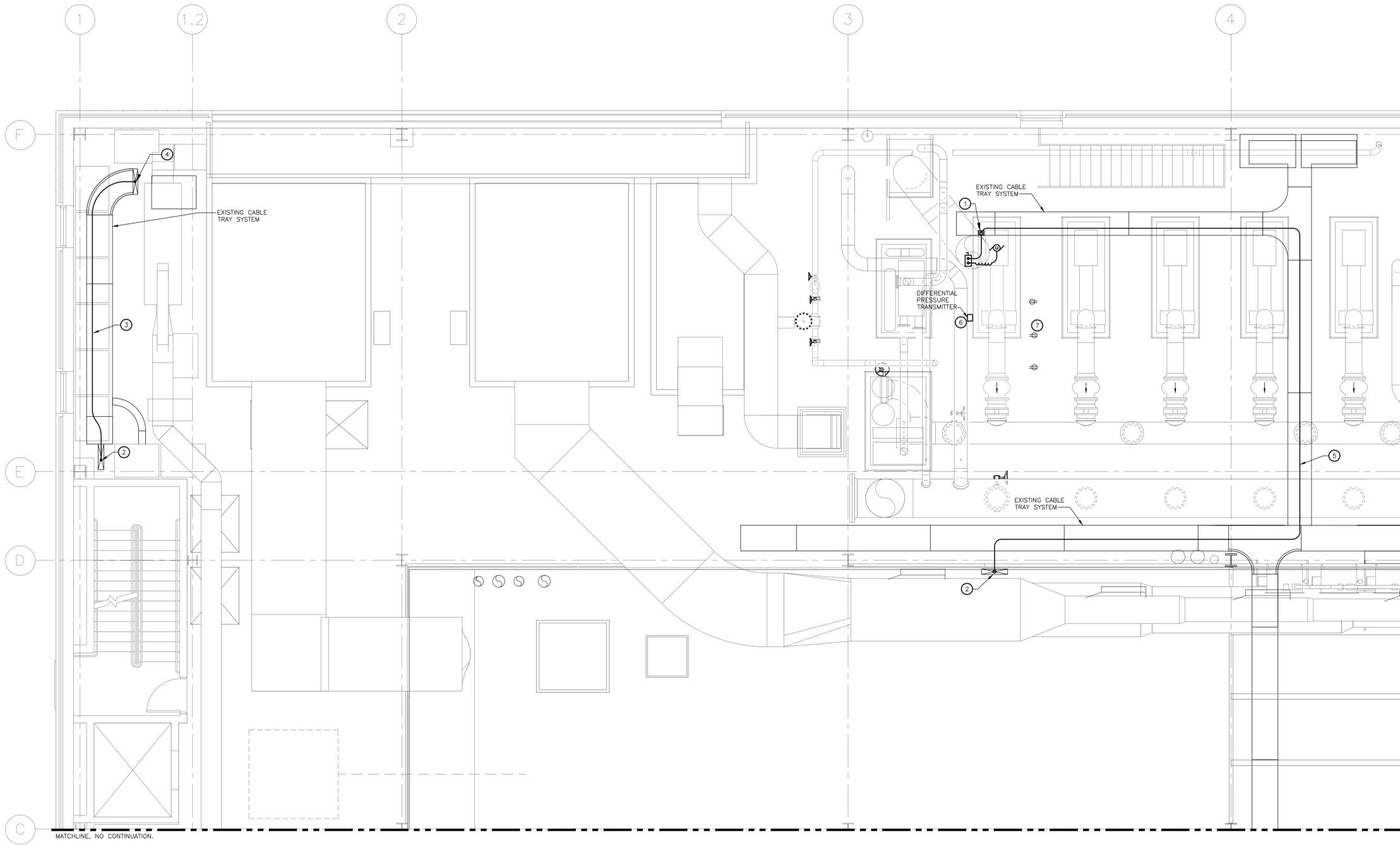
SHEET: 51 of 61



GRAPHIC SCALE  
SCALE: 1/4" = 1'-0"  
UNIT OF MEASURE: FEET

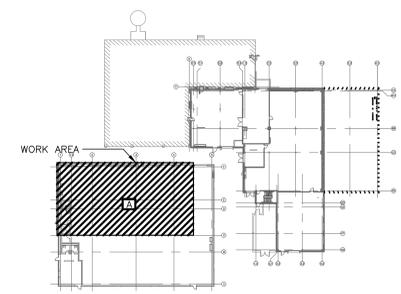
**KEY PLAN**  
SCALE: NONE

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\E204A.dwg



- GENERAL NOTES:**
1. CONDUIT RUN SHALL BE FIELD COORDINATED WITH EXISTING CONDITIONS.
  2. ETHERNET AND RS-485 COMMUNICATION CABLES SHALL BE INSTALLED IN RMC, FASTENED UNDER EXISTING CABLE TRAYS PER MANUFACTURER RECOMMENDATION. ALL OTHER INSTRUMENTATION AND CONTROL CABLES SHALL BE INSTALLED IN EXISTING CABLE TRAYS AND DROPPED TO THEIR TERMINATION POINTS IN RMC.
  3. REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.
  4. REFER TO DRAWING M1.05 FOR CHEMICAL TANK RELOCATION REFERENCED IN DRAWING NOTE 7.

- DRAWING NOTES:**
- 1 INSTALL 6" VERTICAL CABLE TRAY DOWN TO COOLING WATER PUMP 'E'.
  - 2 EXISTING VERTICAL CABLE TRAY FROM 2ND FLOOR.
  - 3 ROUTE BRANCH CIRCUIT FROM VFD-14 TO COOLING TOWER FAN 14 THROUGH EXISTING CABLE TRAY SYSTEM.
  - 4 EXISTING VERTICAL CABLE TRAY TO PULLBOX ON ROOF LEVEL.
  - 5 ROUTE BRANCH CIRCUIT FROM MCC BOP-5 TO NEW COOLING WATER PUMP 'E' THROUGH EXISTING CABLE TRAY SYSTEM.
  - 6 CONTRACTOR TO MATCH NAMING CONVENTION OF EXISTING INSTRUMENTATION.
  - 7 CONTRACTOR SHALL RELOCATE AND REFEED THE EXISTING RECEPTACLES FOR THE EXISTING CHEMICAL TANKS TO THE NEW CHEMICAL TANK LOCATION COORDINATED WITH THE UNIVERSITY.



GRAPHIC SCALE  
 SCALE: 1/4" = 1'-0"  
 UNIT OF MEASURE: FEET

**KEY PLAN**  
 SCALE: NONE

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

REVISIONS:

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 BUILDING SERVICES

31 LEDOYT ROAD UNIT 3038  
 STORRS, CONNECTICUT 06269-3038  
 TELEPHONE: (860) 486-3127  
 FACSIMILE: (860) 486-3177

PROJECT:

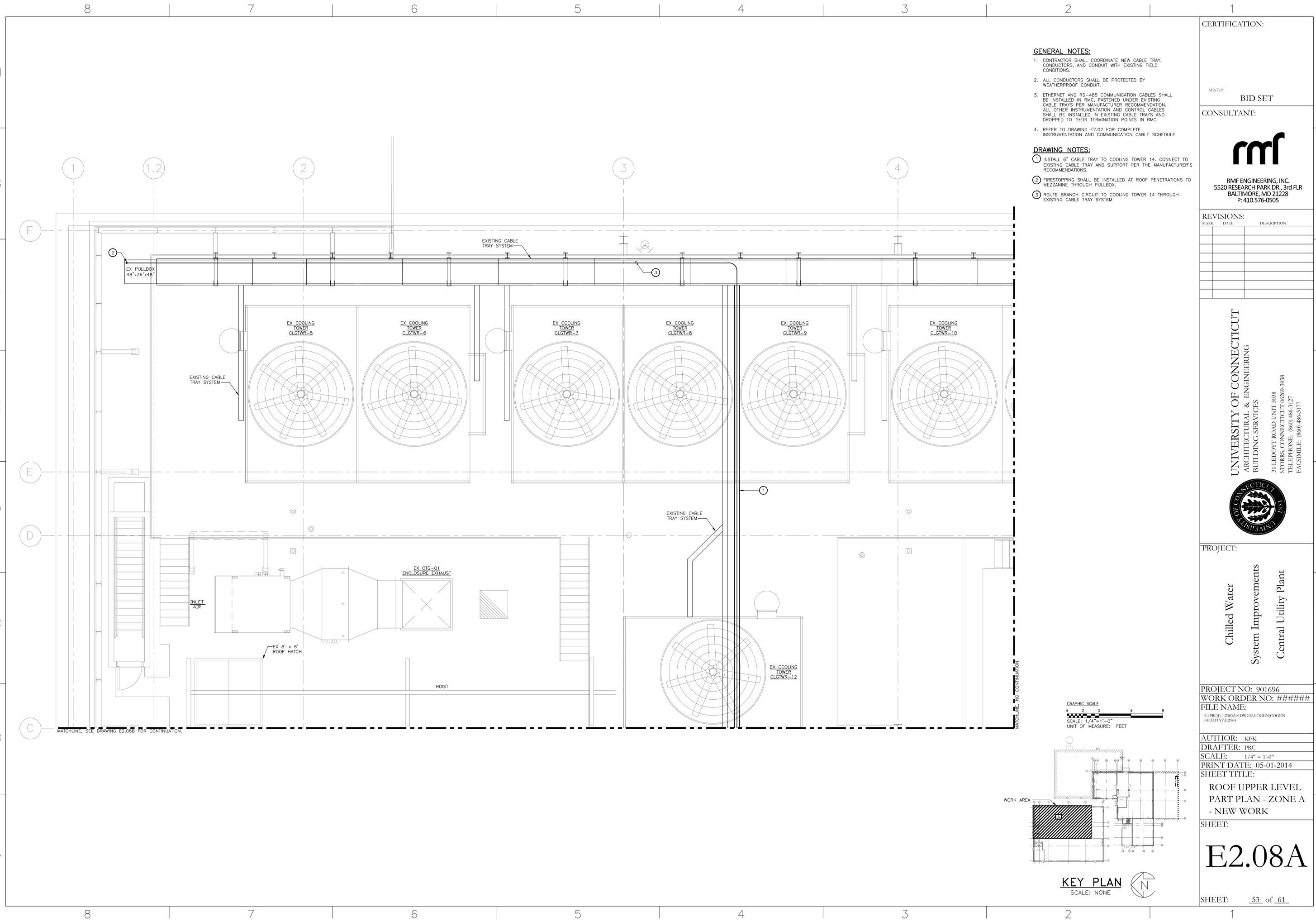
Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\1286A

AUTHOR: KFK  
 DRAFTER: PRC  
 SCALE: 1/4" = 1'-0"  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
 MEZZANINE UPPER  
 LEVEL PART PLAN -  
 ZONE A - NEW WORK

SHEET:  
**E2.06A**

SHEET: 52 of 61



**GENERAL NOTES:**

1. CONTRACTOR SHALL COORDINATE NEW CABLE TRAY, CONDUCTORS, AND CONDUIT WITH EXISTING FIELD CONDITIONS.
2. ALL CONDUCTORS SHALL BE PROTECTED BY WEATHERPROOF CONDUIT.
3. ETHERNET AND RS-485 COMMUNICATION CABLES SHALL BE INSTALLED IN RMC, FASTENED UNDER EXISTING CABLE TRAYS PER MANUFACTURER RECOMMENDATION. ALL OTHER INSTRUMENTATION AND CONTROL CABLES SHALL BE INSTALLED IN EXISTING CABLE TRAYS AND DROPPED TO THEIR TERMINATION POINTS IN RMC.
4. REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.

**DRAWING NOTES:**

- ① INSTALL 6" CABLE TRAY TO COOLING TOWER 14. CONNECT TO EXISTING CABLE TRAY AND SUPPORT PER THE MANUFACTURER'S RECOMMENDATIONS.
- ② FIRESTOPPING SHALL BE INSTALLED AT ROOF PENETRATIONS TO MEZZANINE THROUGH PULLBOX.
- ③ ROUTE BRANCH CIRCUIT TO COOLING TOWER 14 THROUGH EXISTING CABLE TRAY SYSTEM.

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

**REVISIONS:**

MARK	DATE	DESCRIPTION

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BUILDING SERVICES

31 LEDOYT ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



**PROJECT:**

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283\A\DWGS\COGEN\COGEN FACILITY\E2.08A

AUTHOR: KFK

DRAFTER: PRC

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

PRINT DATE: 05-01-2014

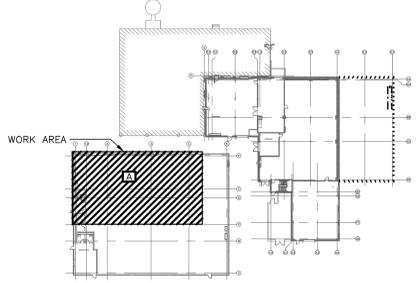
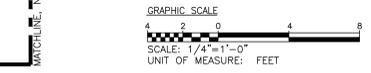
SHEET TITLE:

ROOF UPPER LEVEL  
PART PLAN - ZONE A  
- NEW WORK

SHEET:

**E2.08A**

SHEET: 53 of 61



MATCHLINE, SEE DRAWING E2.08B FOR CONTINUATION.

MATCHLINE, TWO CONTINUATIONS.

8 7 6 5 4 3 2 1

**GENERAL NOTES:**

1. CONTRACTOR SHALL COORDINATE NEW CABLE TRAY, CONDUCTORS, AND CONDUIT WITH EXISTING FIELD CONDITIONS.
2. ETHERNET AND RS-485 COMMUNICATION CABLES SHALL BE INSTALLED IN RMC, FASTENED UNDER EXISTING CABLE TRAYS PER MANUFACTURER'S RECOMMENDATION. ALL OTHER INSTRUMENTATION AND CONTROL CABLES SHALL BE INSTALLED IN EXISTING CABLE TRAYS AND DROPPED TO THEIR TERMINATION POINTS IN RMC.
3. REFER TO DRAWING E7.02 FOR COMPLETE INSTRUMENTATION AND COMMUNICATION CABLE SCHEDULE.

**DRAWING NOTES:**

- ① INSTALL 6" CABLE TRAY TO COOLING TOWER 14. SUPPORT PER THE MANUFACTURER'S RECOMMENDATION.
- ② INSTALL 6" VERTICAL CABLE TRAY 15'-0" DOWN TO THE COOLING TOWER BOX.
- ③ INSTALL COOLING TOWER 14 SAFETY SWITCH IN READILY ACCESSIBLE LOCATION AT THE BASE OF THE COOLING TOWER. FIELD ROUTE BRANCH CIRCUIT TO AND FROM SAFETY SWITCH IN 2" LIQUID TIGHT FLEXIBLE METAL CONDUIT.
- ④ CONTRACTOR TO MATCH NAMING CONVENTION OF EXISTING INSTRUMENTATION.

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

**REVISIONS:**

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDOYT ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3177  
FACSIMILE: (860) 486-3177



**PROJECT:**

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####

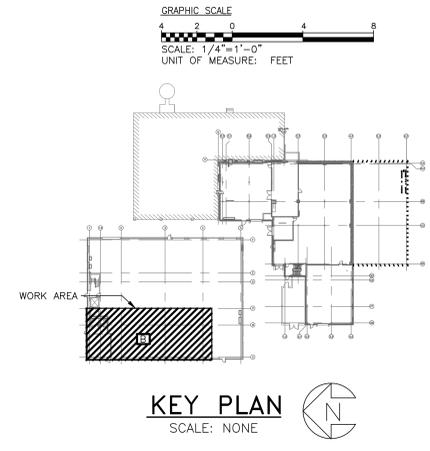
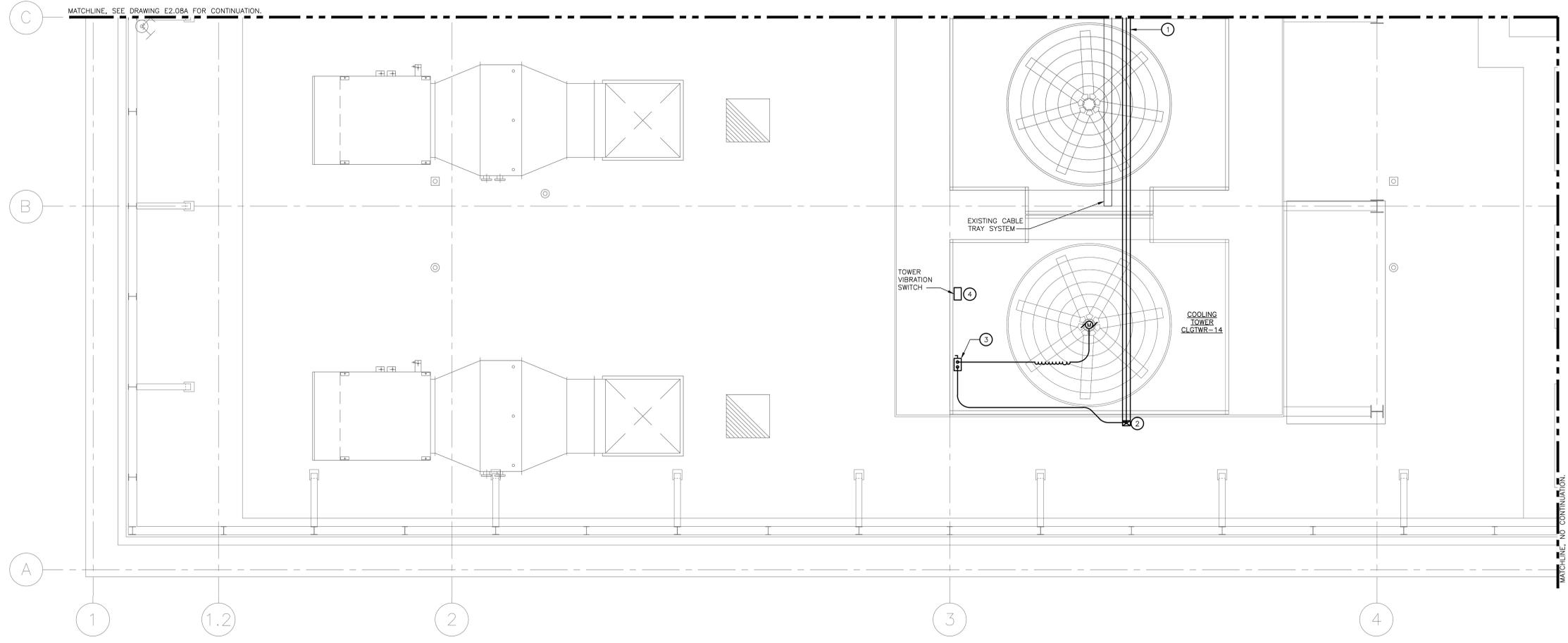
FILE NAME:  
H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\E2.08B

AUTHOR: KFK  
DRAFTER: PRC  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:

ROOF UPPER LEVEL  
PART PLAN - ZONE B  
- NEW WORK

SHEET:  
**E2.08B**

SHEET: 54 of 61



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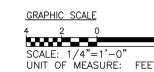
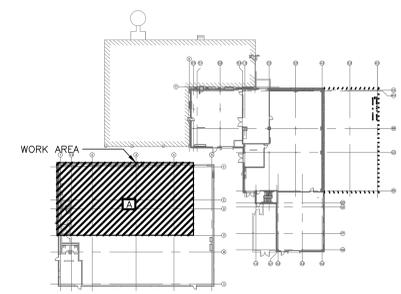
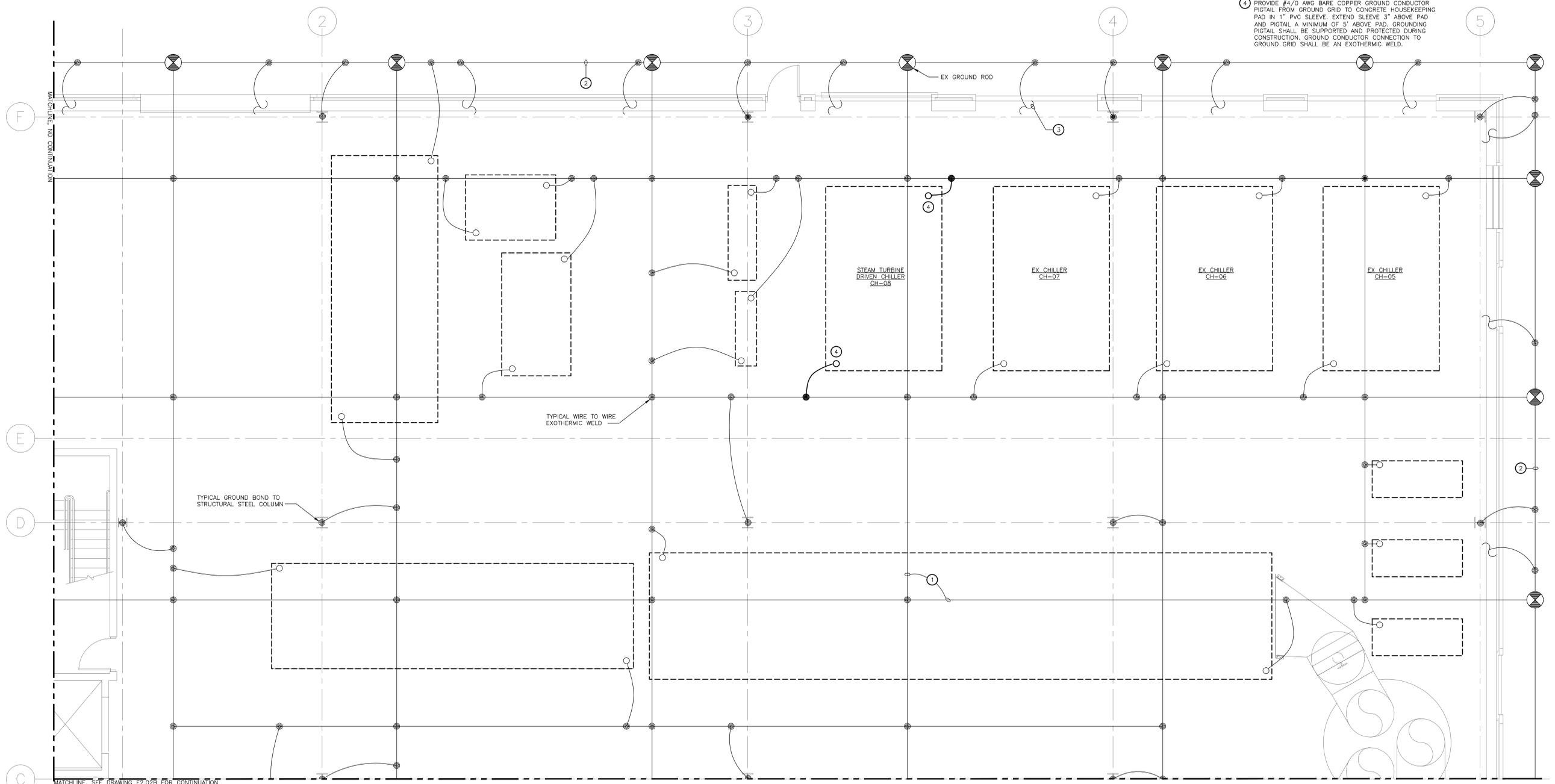
8 7 6 5 4 3 2 1

**GENERAL NOTES:**

1. EXACT LOCATION GROUNDING CONDUCTORS SHALL BE COORDINATED WITH NEW EQUIPMENT AND EXISTING CONDITIONS PRIOR TO POURING CONCRETE.
2. BOND ALL METAL CATWALKS, DECKING, AND RAILINGS TO NEAREST COLUMNS.

**DRAWING NOTES:**

- 1 EXISTING GROUND GRID, #4/0 AWG BARE COPPER GROUND CONDUCTOR BURIED 3'-0" BELOW GRADE.
- 2 EXISTING PERIMETER GROUND RING, #4/0 AWG BARE COPPER GROUND CONDUCTOR LOCATED 3'-0" FROM FOUNDATION AND BURIED 3'-0" BELOW GRADE.
- 3 EXISTING EXOTHERMICALLY WELDED #4/0 AWG BARE COPPER GROUND CONDUCTOR CONNECTION FROM PERIMETER GROUND RING TO REBAR IN GRADE BEAMS.
- 4 PROVIDE #4/0 AWG BARE COPPER GROUND CONDUCTOR PIGTAIL FROM GROUND GRID TO CONCRETE HOUSEKEEPING PAD IN 1" PVC SLEEVE, EXTEND SLEEVE 3" ABOVE PAD AND PIGTAIL A MINIMUM OF 5" ABOVE PAD. GROUNDING PIGTAIL SHALL BE SUPPORTED AND PROTECTED DURING CONSTRUCTION. GROUND CONDUCTOR CONNECTION TO GROUND GRID SHALL BE AN EXOTHERMIC WELD.



**KEY PLAN**  
SCALE: NONE



CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDDY ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\11283AM\DWGS\COGEN\COGEN FACILITY\EG201A

AUTHOR: KFK

DRAFTER: PRC

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

PRINT DATE: 05-01-2014

SHEET TITLE:

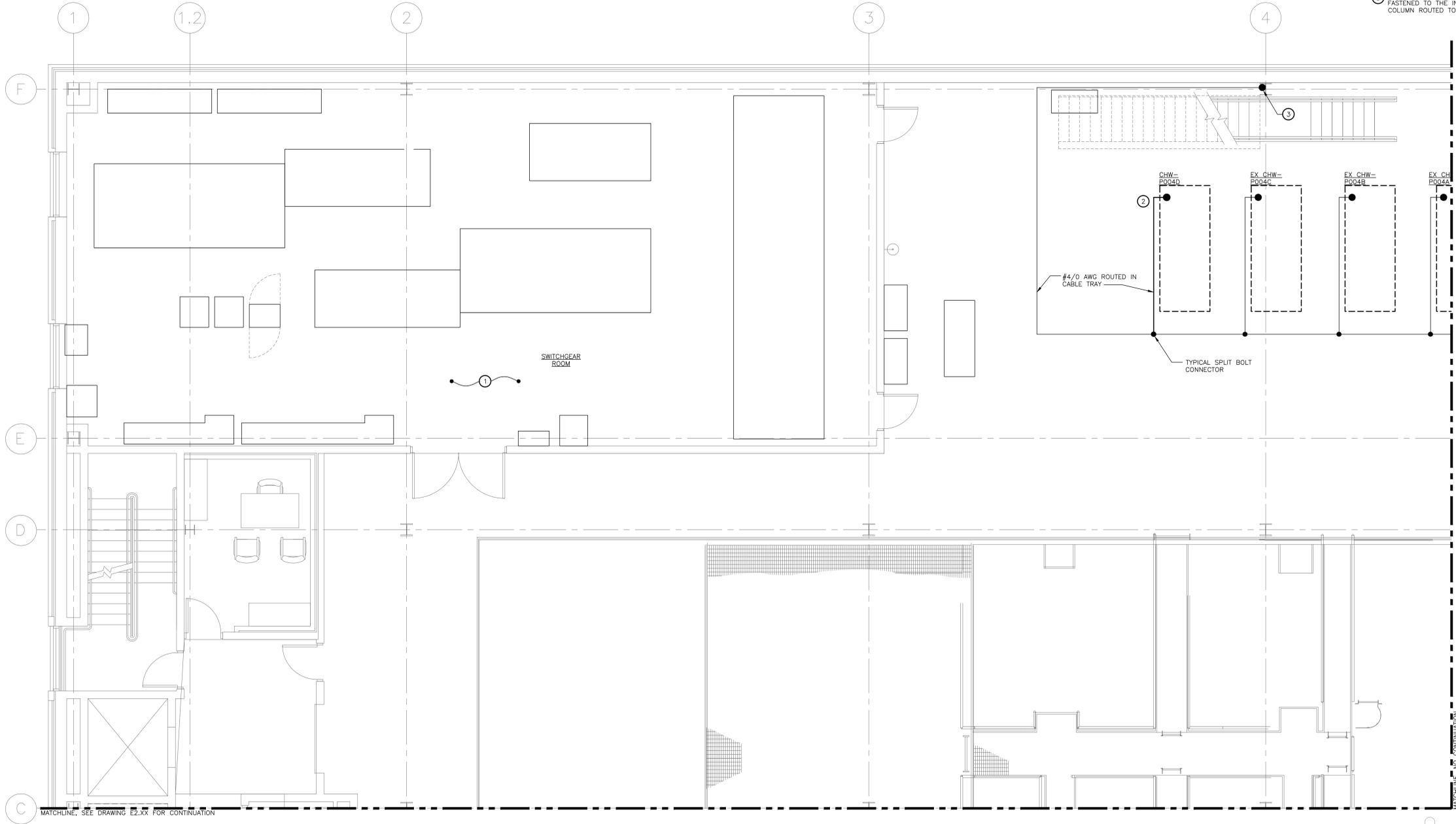
FIRST FLOOR LOWER  
LEVEL PART PLAN -  
ZONE A - GROUNDING

SHEET:

**EG2.01A**

SHEET: 55 of 61

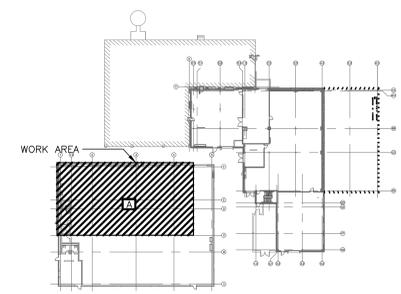
8 7 6 5 4 3 2 1



- GENERAL NOTES:**
- EXACT LOCATION GROUNDING CONDUCTORS SHALL BE COORDINATED WITH NEW EQUIPMENT AND EXISTING CONDITIONS.
  - EQUIPMENT GROUND ROUTING SHOWN IS FOR REFERENCE ONLY. ACTUAL #4/0 EQUIPMENT GROUNDING CONDUCTOR WILL BE RUN THROUGHOUT NEW CABLE TRAY AND WILL DROP TO EQUIPMENT BEING GROUNDED.
- DRAWING NOTES:**
- SWITCHGEAR ROOM HAS AN EXISTING INTERIOR GROUND RING WITH A 1/4" X 2" GROUND BUS WALL MOUNTED 96" AFF. INTERIOR GROUND RING IS CONNECTED TO PERIMETER GROUND RING.
  - PROVIDE #4/0 AWG BARE COPPER GROUND CONDUCTOR PIGTAIL FROM EXISTING CABLE TRAY GROUND CONDUCTOR TO NEW PAD-MOUNTED EQUIPMENT THROUGH THE NEW 6" CABLE TRAY ROUTED TO EQUIPMENT. NEW EQUIPMENT GROUNDING CONDUCTOR SHALL BE CONNECTED TO THE GROUNDING CONDUCTOR IN EXISTING CABLE TRAY WITH A SPLIT BOLT CONNECTOR. GROUNDING PIGTAIL SHALL BE SUPPORTED AND PROTECTED DURING CONSTRUCTION.
  - EXISTING #4/0 AWG BARE COPPER GROUNDING CONDUCTOR FASTENED TO THE INSIDE WEB OF STRUCTURAL STEEL COLUMN ROUTED TO THE GROUND GRID ON FIRST FLOOR.

MATCHLINE, SEE DRAWING EG2.02 FOR CONTINUATION

MATCHLINE, NO CONTINUATION



GRAPHIC SCALE  
 SCALE: 1/4"=1'-0"  
 UNIT OF MEASURE: FEET

**KEY PLAN**  
 SCALE: NONE

**CERTIFICATION:**

STATUS: **BID SET**

**CONSULTANT:**

**rmf**

RMF ENGINEERING, INC.  
 5520 RESEARCH PARK DR., 3rd FLR  
 BALTIMORE, MD 21228  
 P: 410.576-0505

**REVISIONS:**

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
 ARCHITECTURAL & ENGINEERING  
 BUILDING SERVICES

31 LEDDY ROAD UNIT 3038  
 STORRS, CONNECTICUT 06269-3038  
 TELEPHONE: (860) 486-3177  
 FACSIMILE: (860) 486-3177

**PROJECT:**

Chilled Water  
 System Improvements  
 Central Utility Plant

PROJECT NO: 901696  
 WORK ORDER NO: #####  
 FILE NAME:  
 H:\PROJ\11283\AP\DWGS\COGEN\COGEN FACILITY\EG203A

AUTHOR: KFK  
 DRAFTER: PRC  
 SCALE: 1/4" = 1'-0"  
 PRINT DATE: 05-01-2014  
 SHEET TITLE:  
 2ND FLOOR LOWER  
 LEVEL PART PLAN -  
 ZONE A - GROUNDING

SHEET:  
**EG2.03A**

SHEET: 56 of 61

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8 7 6 5 4 3 2 1

- GENERAL NOTES:**
1. EXACT LOCATION GROUNDING CONDUCTORS SHALL BE COORDINATED WITH NEW EQUIPMENT AND EXISTING CONDITIONS.
  2. EQUIPMENT GROUND ROUTING SHOWN IS FOR REFERENCE ONLY. ACTUAL #4/0 EQUIPMENT GROUNDING CONDUCTOR WILL BE RUN THROUGH NEW CABLE TRAY AND WILL DROP TO EQUIPMENT BEING GROUNDED.
- DRAWING NOTES:**
- 1 PROVIDE #4/0 AWG BARE COPPER GROUND CONDUCTOR PIGTAIL FROM EXISTING CABLE TRAY GROUND CONDUCTOR TO NEW PAD-MOUNTED EQUIPMENT THROUGH THE NEW 6" CABLE TRAY ROUTED TO EQUIPMENT. NEW EQUIPMENT GROUNDING CONDUCTOR SHALL BE CONNECTED TO THE GROUNDING CONDUCTOR IN EXISTING CABLE TRAY WITH A SPLIT BOLT CONNECTOR. GROUNDING PIGTAIL SHALL BE SUPPORTED AND PROTECTED DURING CONSTRUCTION.
  - 2 EXISTING #4/0 AWG BARE COPPER GROUNDING CONDUCTOR FASTENED TO THE INSIDE WEB OF STRUCTURAL STEEL COLUMN ROUTED TO THE GROUND GRID ON FIRST FLOOR.

CERTIFICATION:  
STATUS: **BID SET**

CONSULTANT:  
**rmf**  
RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
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BUILDING SERVICES  
31 LEDDY ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

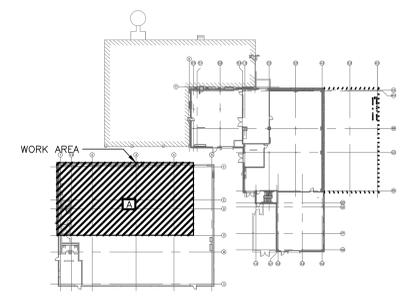
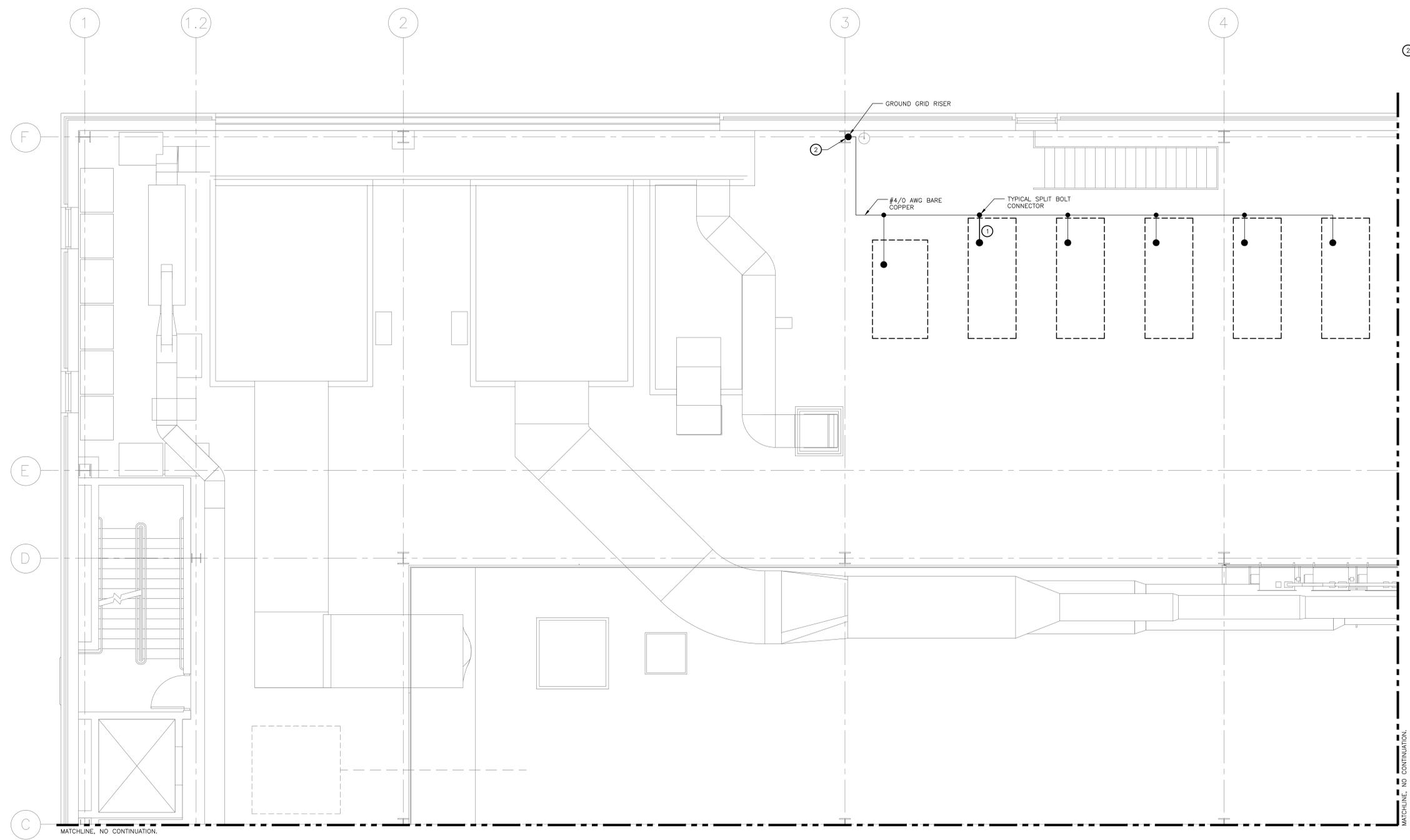


PROJECT:  
**Chilled Water  
System Improvements  
Central Utility Plant**

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\112838\DWGS\COGEN\COGEN  
FACILITY\EG205A

AUTHOR: KFK  
DRAFTER: PRC  
SCALE: 1/4" = 1'-0"  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
**MEZZANINE LOWER  
LEVEL PART PLAN -  
ZONE A - GROUNDING**

SHEET:  
**EG2.05A**  
SHEET: 57 of 61



GRAPHIC SCALE  
SCALE: 1/4" = 1'-0"  
UNIT OF MEASURE: FEET

**KEY PLAN**  
SCALE: NONE



**GENERAL NOTES:**

1. EXACT LOCATION GROUNDING CONDUCTORS SHALL BE COORDINATED WITH NEW EQUIPMENT AND EXISTING CONDITIONS.
2. BOND ALL METAL CATWALKS, DECKING, AND RAILINGS TO NEAREST COLUMNS.

**DRAWING NOTES:**

- ① EXISTING ROOF GROUND RING. #4/0 AWG BARE COPPER GROUND CONDUCTOR. ROOF GROUND RING IS CONNECTED TO THE BUILDING STRUCTURAL STEEL DOWN TO PERIMETER GROUND RING.
- ② PROVIDE #4/0 AWG BARE COPPER GROUND CONDUCTOR AND BOND NEW COOLING TOWER EQUIPMENT AND ALL STRUCTURAL METAL, CATWALKS, RAILINGS, DECKING TO THE EXISTING ROOF GROUND RING.

CERTIFICATION:

STATUS:

**BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDOYT ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112838\DWGS\COGEN\COGEN FACILITY\EG207B

AUTHOR: KFK

DRAFTER: PRC

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

PRINT DATE: 05-01-2014

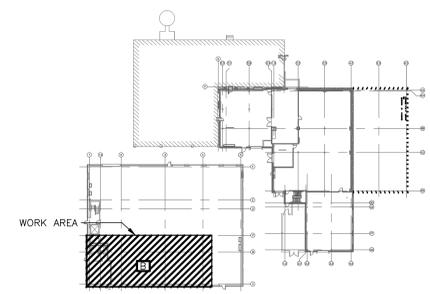
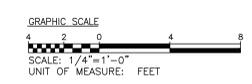
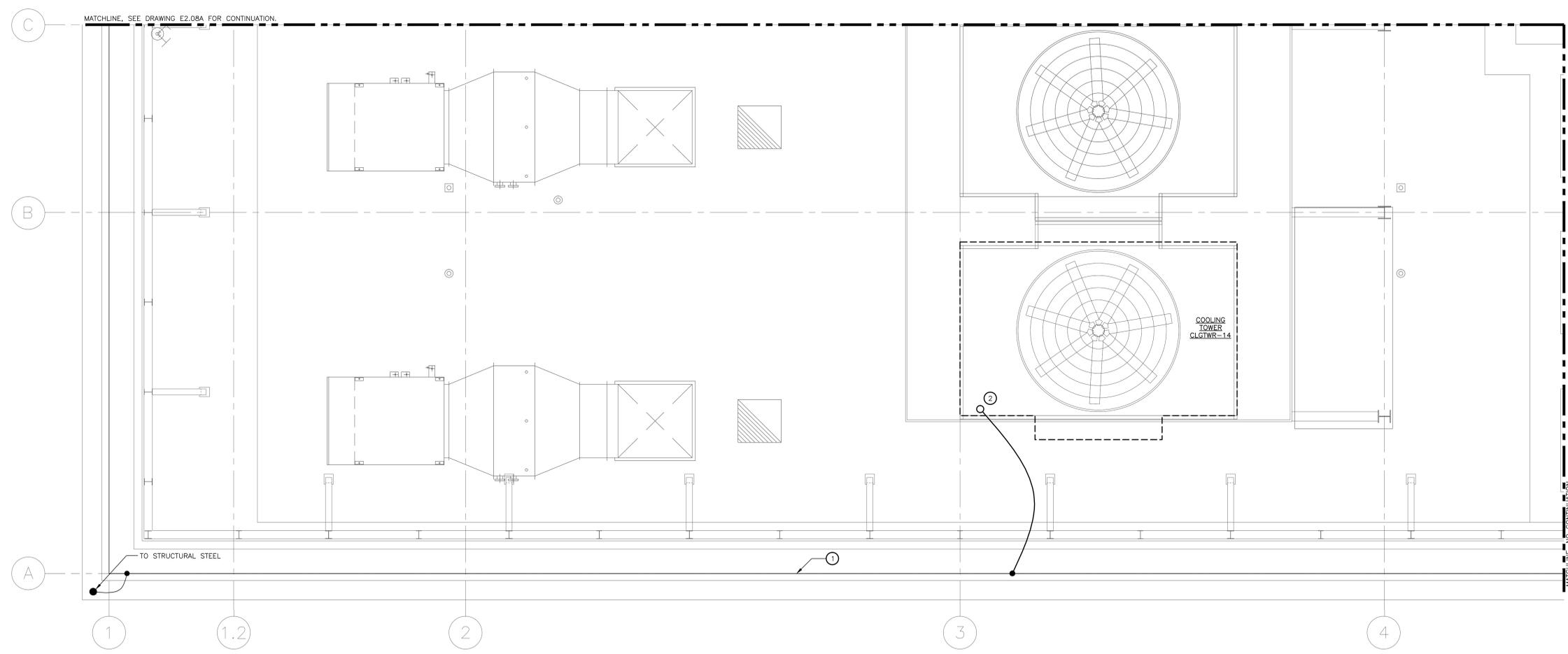
SHEET TITLE:

ROOF LOWER LEVEL  
PART PLAN - ZONE B -  
GROUNDING

SHEET:

**EG2.07B**

SHEET: 58 of 61



**KEY PLAN**  
SCALE: NONE



**GENERAL NOTES:**

1. ANY REFERENCING TO DRAWINGS NOT CONTAINED WITHIN THIS SET REFERS TO THE EXISTING CONSTRUCTION DOCUMENTS OF THE FACILITY. THESE DRAWINGS SHALL ONLY BE USED AS A REFERENCE FOR EXISTING FACILITY CONDITIONS OUTSIDE THE SCOPE OF THIS PROJECT.
2. FOR INSTALLATION OF ALL NEW BREAKERS, COORDINATE SHUTDOWN AND INSPECTION WITH THE PLANT AND THE OFFICE OF FIRE MARSHAL & BUILDING INSPECTOR (OFMBI).

CERTIFICATION:

STATUS:

**BID SET**

CONSULTANT:



RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES



31 LEDDY ROAD UNIT 3038  
STORRS, CONNECTICUT 06269-3038  
TELEPHONE: (860) 486-3177  
FACSIMILE: (860) 486-3177

PROJECT:

Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696

WORK ORDER NO: #####

FILE NAME:

H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\E501

AUTHOR: KFK

DRAFTER: PRC

SCALE: NONE

PRINT DATE: 05-01-2014

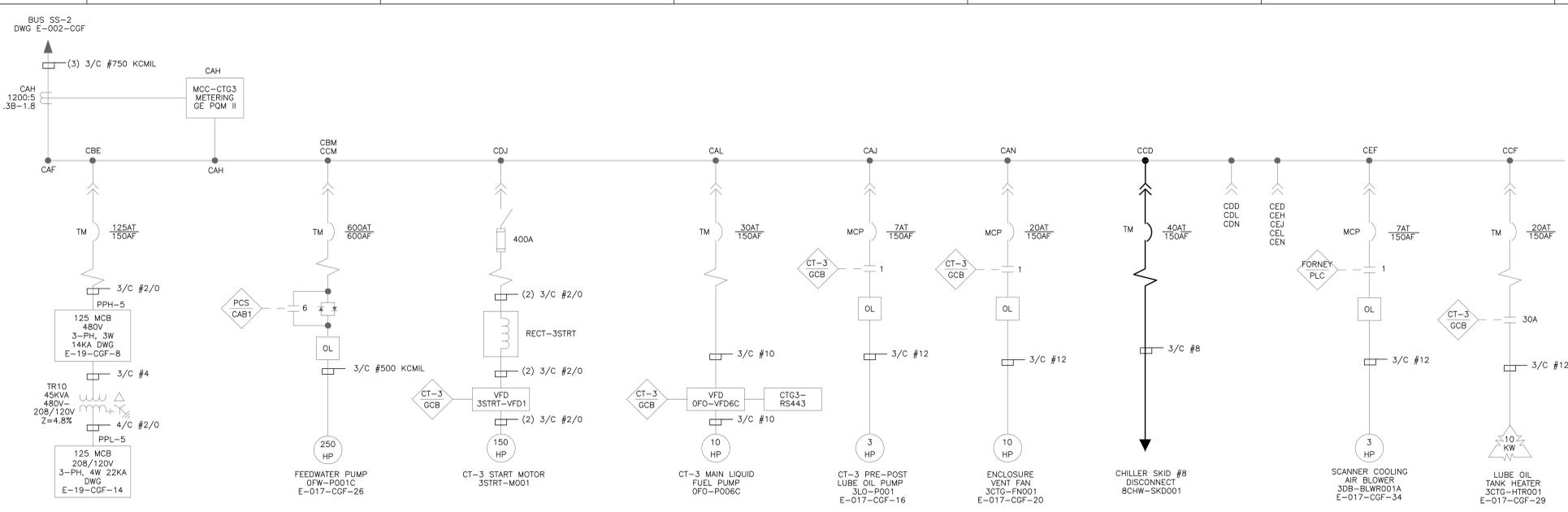
SHEET TITLE:

MCC CTG3, BOP4  
& BOP5 - ONE LINE  
DIAGRAM

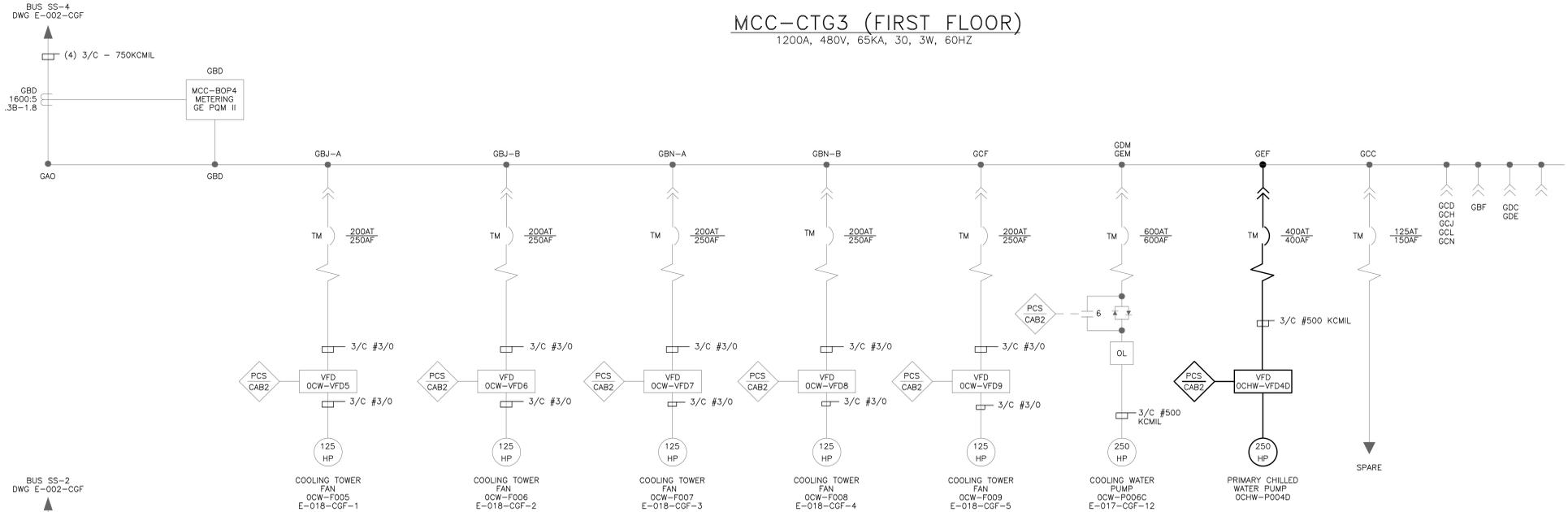
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**E5.01**

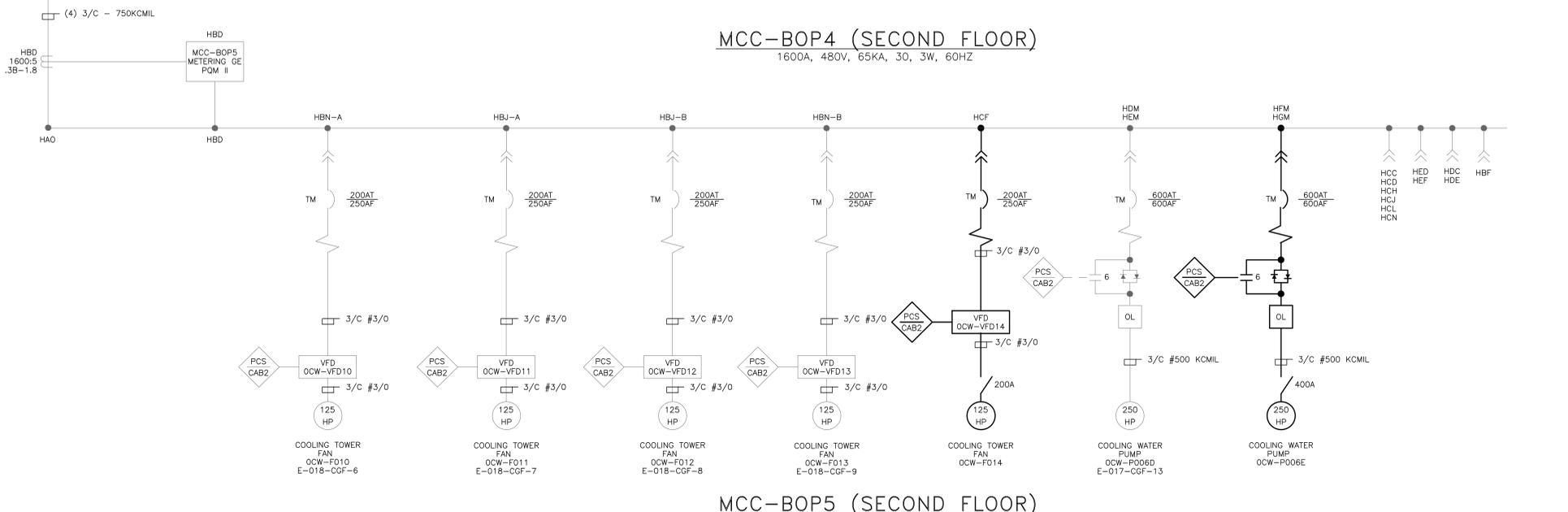
SHEET: 59 of 61



**MCC-CTG3 (FIRST FLOOR)**  
1200A, 480V, 65KA, 30, 3W, 60HZ

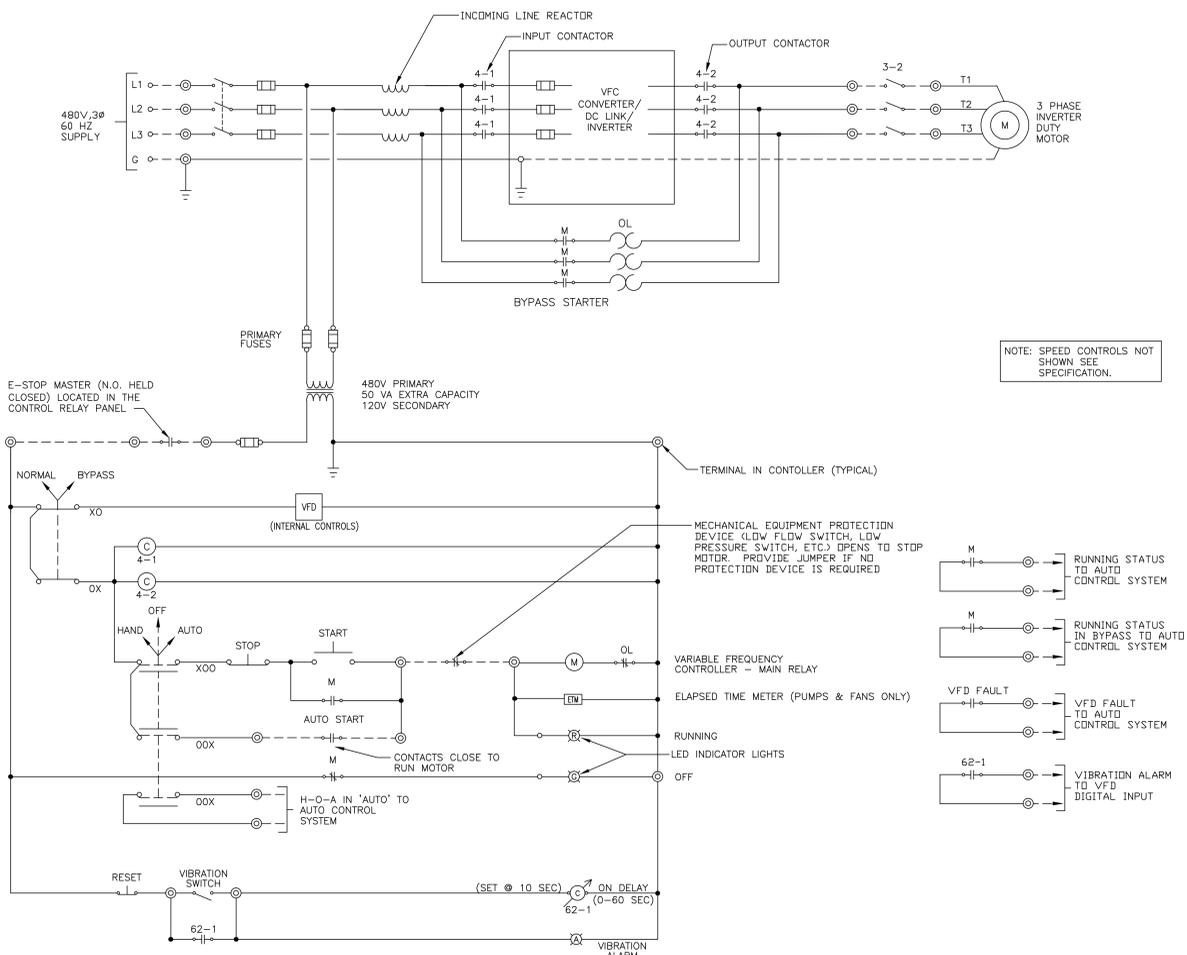


**MCC-BOP4 (SECOND FLOOR)**  
1600A, 480V, 65KA, 30, 3W, 60HZ



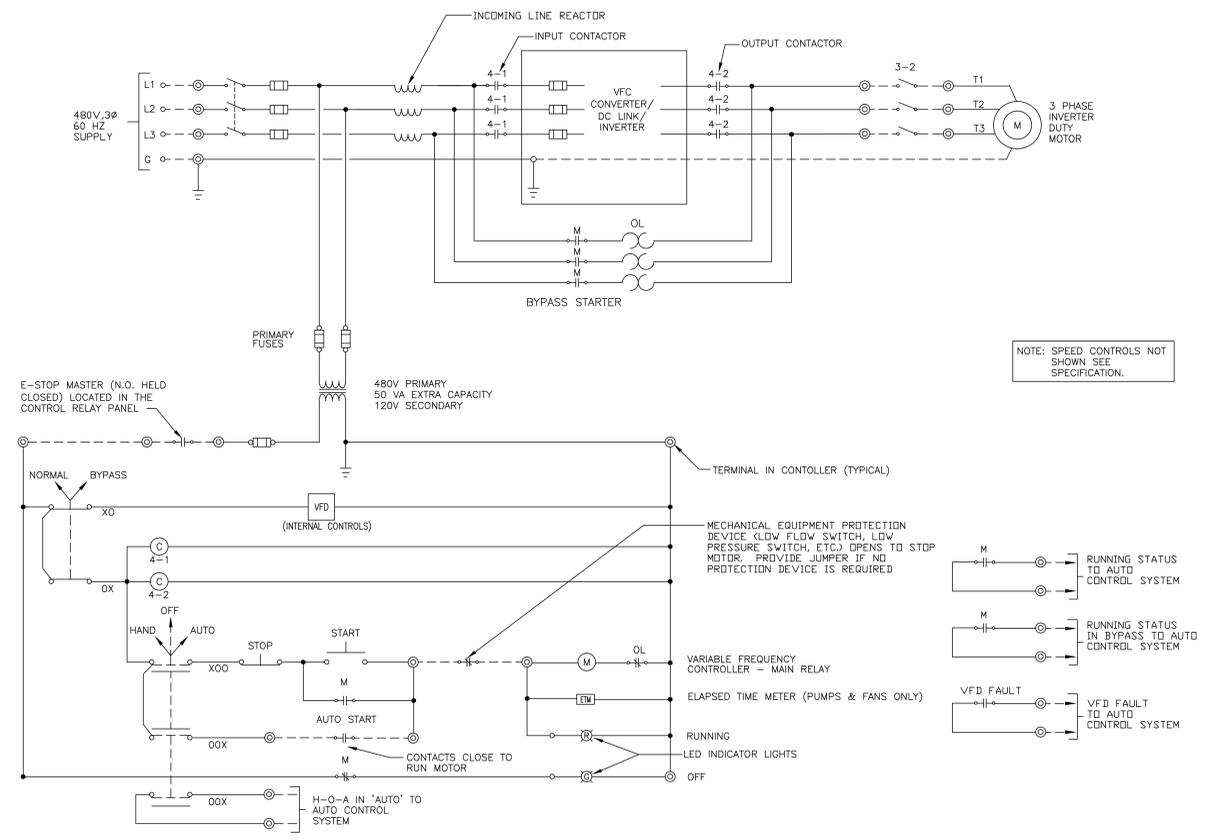
**MCC-BOP5 (SECOND FLOOR)**  
1600A, 480V, 65KA, 30, 3W, 60HZ

H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\E501.dwg



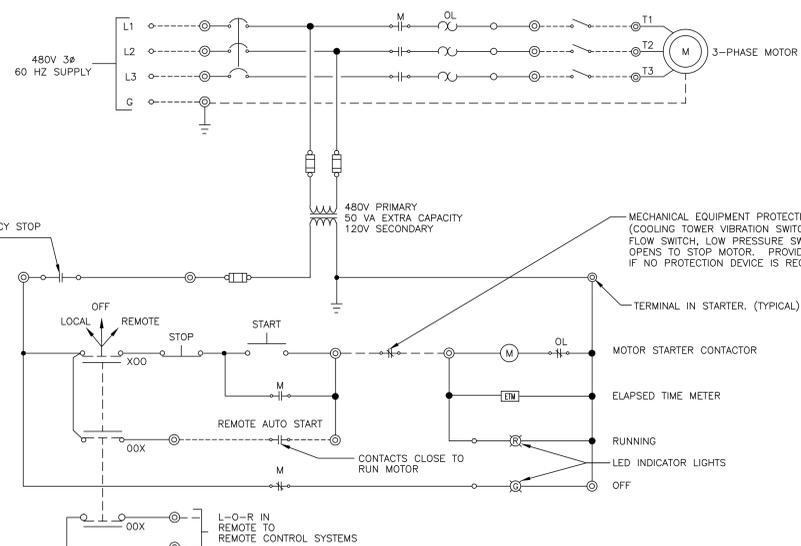
**COOLING TOWER VARIABLE FREQUENCY DRIVE**  
SCALE: NONE

NOTES:  
1. PROVIDE WINDING OVER TEMPERATURE PROTECTION AS SPECIFIED.



**CHILLED WATER PUMP VARIABLE FREQUENCY DRIVE**  
SCALE: NONE

NOTES:  
1. PROVIDE WINDING OVER TEMPERATURE PROTECTION AS SPECIFIED.



**3-PHASE MOTOR CONTROL WIRING**  
SCALE: NONE

INCLINE	UL	UL	UL	UL	UL
UL 1200					
	FDRCB 25	FDRCB 40	SPACE	SPACE	
		CCD CONT 20	CDD FDRFUSW 400A	CED FVNR 1	
CAF	CBE	CCF		CEF	
METERING	DISCONNECT 600	SSS 250		SPACE	
CAH				CEH	
FVNR				SPACE	
CAJ			CDJ	CEJ	
FDRCB 30			SPACE	SPACE	
CAL			CDL	CEL	
FVNR 1			SPACE	SPACE	
CAN	CBM	CCM	CDN	CEN	

**MCC-CTG3 (FIRST FLOOR)**  
1200A, 480V, 65KA, 30, 3W, 60HZ

INCLINE	UL	UL	UL	UL	UL
UL 1600					
METERING	FDRCB/125 GDC/SPARE	SPACE GDC	SPACE	FDRCB 400	
GBD	SPACE GDC	SPACE			
SPACE	FDRCB 200	GDE DISCONNECT 600		GEF	
GBF	GCF			SSS 250	
FDRCB 200/200	SPACE				
	GCH				
	SPACE				
	GCI				
	SPACE				
	GCL				
	SPACE				
GAO	GBN	GCN	GDM	GEM	

**MCC-BOP4 (SECOND FLOOR)**  
1600A, 480V, 65KA, 30, 3W, 60HZ

INCLINE	UL	UL	UL	UL	UL	UL
UL 1600						
METERING	SPACE HCC	SPACE HDC	SPACE	SPACE	SPACE HFC	SPACE
HBD	SPACE HCD	SPACE HCE	SPACE	SPACE HFE	SPACE HGD	SPACE
SPACE	FDRCB 200	HDE DISCONNECT 600	HEF	SSS 250	HFE DISCONNECT 600	HGF
HBF	SPACE					SSS 250
FDRCB 200/200	HCH					
	SPACE					
	HCI					
	SPACE					
	HCL					
	SPACE					
	HCM					
HAO	HBN	HCN	HDM	HEM	HFM	HGM

**MCC-BOP5 (SECOND FLOOR)**  
1600A, 480V, 65KA, 30, 3W, 60HZ

CERTIFICATION:

STATUS: **BID SET**

CONSULTANT:

**rmf**

RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES

31 LEDOYT ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177

PROJECT:  
**Chilled Water  
System Improvements  
Central Utility Plant**

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\112383\DWGS\COGEN\COGEN FACILITY\E701

AUTHOR: KFK  
DRAFTER: PRC  
SCALE: NONE  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
**ELECTRICAL  
DETAILS**

SHEET:  
**E7.01**

SHEET: 60 of 61

CERTIFICATION:  
  
STATUS: **BID SET**

CONSULTANT:  
  
**rmf**  
  
RMF ENGINEERING, INC.  
5520 RESEARCH PARK DR., 3rd FLR  
BALTIMORE, MD 21228  
P: 410.576-0505

REVISIONS:

MARK	DATE	DESCRIPTION

UNIVERSITY OF CONNECTICUT  
ARCHITECTURAL & ENGINEERING  
BUILDING SERVICES  
31 LEDDY ROAD UNIT 3088  
STORRS, CONNECTICUT 06269-3088  
TELEPHONE: (860) 486-3127  
FACSIMILE: (860) 486-3177



PROJECT:  
  
Chilled Water  
System Improvements  
Central Utility Plant

PROJECT NO: 901696  
WORK ORDER NO: #####  
FILE NAME:  
H:\PROJ\11238\A\DWGS\COGEN\COGEN  
FACILITY\U702

AUTHOR: wwm  
DRAFTER: RIC  
SCALE: NONE  
PRINT DATE: 05-01-2014  
SHEET TITLE:  
**INSTRUMENTATION  
& COMMUNICATION  
CABLE SCHEDULE**

SHEET:  
  
**E7.02**  
  
SHEET: 61 of 61

POINTS LIST - CABLE SCHEDULE

CABLE TAG	POINT TAG	DESCRIPTION	CABLE TYPE	I/O TYPE	VOLTAGE	FROM LOCATION	TO LOCATION
IC-CH08-001	FT-OCHW-108	CHILLER-8 CHILLED WATER FLOW METER SIGNAL	#16 TSP	AI	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-002	FT-OCHW-108	CHILLER-8 CHILLED WATER FLOW METER POWER	3C #12	N/A	120 VAC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-003	ZC-CHR-008	CHILLER-8 CHILLED WATER INLET CONTROL VALVE POSITION CONTROL	#16 TSP	AO	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-004	ZT-CHR-008	CHILLER-8 CHILLED WATER INLET CONTROL VALVE POSITION TRANSMITTER	#16 TSP	AI	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-005	ZC-CS-003D	CHILLER-8 CONDENSER WATER INLET FLOW VALVE POSITION CONTROL	3C #14	DO	120 VAC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-006	ZSC-CS-003D & ZSO-CS-003D	CHILLER-8 CONDENSER WATER INLET FLOW VALVE POSITION SWITCHES CLOSED /OPEN	3C #14	DI	120 VAC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-007	FT-OCW-008	CHILLER-8 CONDENSER WATER FLOW METER SIGNAL	#16 TSP	AI	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-008	FT-OCW-008	CHILLER-8 CONDENSER WATER FLOW METER POWER	3C #12	N/A	120 VAC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-009	CC-CHLR-008	CHILLER-8 CONTROL PANEL INTERFACE	Cat5e	Serial	N/A	CHILLER-8 on 1st Floor (Dwg M2.01)	ETHERNET SWITCH #5
IC-CH08-010	VFD-CHW-P004D	PRIMARY CHILLED WATER PUMP CHW-P004D VFD COMMUNICATION	Qty=2 #24 TSP Belden 9841 EIA-485	Serial	N/A	CHW-P004D on 2nd Floor (Dwg. M2.03)	NEAREST PUMP VFD
IC-CH08-011	HS-CHW-P004D	PRIMARY CHILLED WATER PUMP CHW-P004D VFD START/STOP	3C #14	DO	24 VDC	CHW-P004D on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-012	SC-CHW-P004D	PRIMARY CHILLED WATER PUMP CHW-P004D VFD SPEED SIGNAL	#16 TSP	AO	24 VDC	CHW-P004D on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-013	IT-CHW-P004D	PRIMARY CHILLED WATER PUMP CHW-P004D VFD MOTOR CURRENT	#16 TSP	AI	24 VDC	CHW-P004D on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-014	HS-CW-P006E	COOLING WATER PUMP CW-P006E START/STOP	3C #14	DO	24 VDC	CW-P006E on 2nd Floor Mezz (Dwg. M2.05)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-015	DPT-CS-006E	COOLING WATER PUMP CW-P006E TEE STRAINER DIFFERENTIAL PRESSURE TRANSMITTER	#16 TSP	AI	24 VDC	CW-P006E on 2nd Floor Mezz (Dwg. M2.05)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-016	IT-CS-006E	COOLING WATER PUMP CW-P006E CURRENT TRANSMITTER (FAILED TO START" ALARM ON PCS) "	#16 TSP	AI	24 VDC	CW-P006E on 2nd Floor Mezz (Dwg. M2.05)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-017	TT-CS-014	14-CLGTWR CONDENSER WATER SUPPLY TEMPERATURE TRANSMITTER	#16 TSP	AI	24 VDC	14-CLGTWR on Roof (Dwg. M2.08)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-018	VFD-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VFD COMMUNICATION	Qty=2 #24 TSP Belden 9841 EIA-485	Serial	N/A	14-CLGTWR-VFD on 2nd Floor (Dwg. M2.03)	NEAREST COOLING TOWER FAN VFD
IC-CH08-019	HS-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VFD START/STOP	3C #14	DO	24 VDC	14-CLGTWR-VFD on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-020	SC-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VFD SPEED SIGNAL	#16 TSP	AO	24 VDC	14-CLGTWR-VFD on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-021	IT-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VFD MOTOR CURRENT	#16 TSP	AI	24 VDC	14-CLGTWR-VFD on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-022	VS-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VIBRATION SWITCH POWER	3C #12	N/A	120 VAC	COOLING TOWER FAN #14 CROSS MEMBER ON ROOF	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-023	VSH-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VIBRATION SWITCH TRIP	3C #14	DI	120 VAC	COOLING TOWER FAN #14 CROSS MEMBER ON ROOF	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-024	VT-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VIBRATION TRANSDUCER SIGNAL	#16 TSP	AI	24 VDC	COOLING TOWER FAN #14 CROSS MEMBER ON ROOF	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-025	LSL-CLGTWR-014	14-CLGTWR COOLING TOWER FAN GEARBOX LOW OIL LEVEL SWITCH TRIP	3C #14	DI	120 VAC	COOLING TOWER FAN #14 GEARBOX ON ROOF	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-026	XA-CLGTWR-014	14-CLGTWR COOLING TOWER FAN VIBRATION/LOW OIL LEVEL SWITCH INTERLOCK WITH VFD	3C #14	N/A	120 VAC	14-CLGTWR-VFD on 2nd Floor (Dwg. M2.03)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-027	HS-CHLR-008	CHILLER-8 REMOTE START/STOP	3C #14	DO	120 VAC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-028	TY-CHLR-008	CHILLER-8 REMOTE LEAVING CHW SETPOINT	#16 TSP	AO	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM
IC-CH08-029	JY-CHLR-008	CHILLER-8 REMOTE TURBINE HORSEPOWER LIMIT SETPOINT	#16 TSP	AO	24 VDC	CHILLER-8 on 1st Floor (Dwg M2.01)	BOP PCS CABINET #2 IN SWITCHGEAR ROOM

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# **BID SUBMISSION**

**FOR**

## **Central Utility Plant Upgrade Chilled Water System**

**UNIVERSITY OF CONNECTICUT  
STORRS CAMPUS  
Storrs, Connecticut**

**PROJECT NUMBER: #901696**



**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**Proposal Submission Checklist**

The following documents and information shall be submitted and included as your bid proposal. All documents must be submitted in a sealed envelope reflecting the submitting firm's name and address; addressed to CPCA attention to the appropriate purchasing agent, clearly stating the project name and project number. All required documents are to be included and executed in their original condition as issued.

- Ethics Forms 5 (if contract value is > \$50,000) and 6 (if contract value is > \$500,000).
- Bid Bond
- Fully executed Form of Proposal
- Copies of prequalification certificate and an updated statement as prescribed by Commissioner of Administrative Services for the State of Connecticut.
- How did you learn about this Project?
  - Hartford Courant
  - Waterbury Republican
  - Norwich Bulletin
  - DAS
  - CPCA Website
  - Other \_\_\_\_\_

**Contractors Certification**

**By submitting a bid proposal, the bidder is attesting to the review, reading, understanding, and acceptance of the information and requirements of the project contained within the bid documents without exception. By submitting a bid proposal, the Bidder represents that they have examined the site, and accept the conditions under which the work will be performed and we have read, evaluated, understand, and accepted all the Contract Documents, including those documents provided for on the Disk, and their content in their entirety and have included all provisions necessary to accomplish all work according to the information and requirements prescribed therein without exception.**

SUBMITTED BY:

Firm: \_\_\_\_\_

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

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

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

Print Name: \_\_\_\_\_

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

Telephone: \_\_\_\_\_

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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University of Connecticut  
Walt Dalia, Purchasing Agent II  
Capital Project & Contract Administration  
3 North Hillside Road, Unit 6047  
Storrs, Connecticut 06269-6047

Dear Mr. Dalia:

1. In accordance with Connecticut General Statutes Sections 10a-109a through 10a-109y and pursuant to, and in compliance with your Invitation to Bid, the Notice and Instructions to Bidders, the Form of Contract, including the conditions thereto, the form of required bond, I (we) propose to furnish the labor and/or materials installed as required for the project named and numbered on the FORM OF PROPOSAL of this proposal to the extent of the Proposal submitted herein, furnishing all necessary equipment, machinery, tools, labor and other means of construction, and all materials specified in the manner and at the time prescribed strictly in accordance with the provisions of the Contract including specifications and/or drawings together with all addenda issued and received prior to the scheduled closing time for the receipt of the bids, and in conformity with requirements of the University of Connecticut and any laws or departmental regulations of the State of Connecticut or of the United States which may affect the same, for and in consideration of the price(s) stated on the said FORM OF PROPOSAL, hereof.
2. The Lump Sum Base Bid by me (us) on the FORM OF PROPOSAL includes all work indicated on the drawings and/or described in the specifications (including the furnishing and installing of all required materials, labor, equipment and allowances where applicable), except:
  - A. Work covered by Alternates as may be listed on the FORM OF PROPOSAL.
  - B. Contingent work covered by Unit Prices as may be listed on the FORM OF PROPOSAL.
  - C. Work covered by Options as may be listed on the FORM OF PROPOSAL.
3. This proposal is submitted subject to and in compliance with the foregoing and following conditions and/or information.
  - A. AWARD: All proposals shall be subject to the provisions and requirements of the Bid Documents and for purpose of award, consideration shall be given only to proposals submitted by qualified and responsible bidders.
  - B. COMMENCEMENT AND COMPLETION OF WORK: Contractor shall commence and complete the work in accordance with the requirements of the Contract Documents.
  - C. If the Contractor fails to complete the work within the time required by the Contract Documents, the University shall have the right to assess liquidated damages as provided in Paragraph 9.11 of the General Conditions.
  - D. CONTRACTORS INSURANCE REQUIRED:
    1. The limits of liability and coverages shall be those set forth in Article 11 of the General Conditions included with this bid package (or as previously executed with the on-call trade contract).
  - E. REQUIRED PERCENTAGES OF WORK AND SET-ASIDES

FORM OF PROPOSAL

- .1 If awarded this contract, we (I) as the General Contractor on this Project shall be required to perform not less than 10% of the completed dollar value of the Work with its own forces.
- .2 We (I) as the General Contractor on this project shall award not less than 25% of the total Contract Price to subcontractors who are certified and eligible to participate under the State of Connecticut Small Business Set Aside Program, of which 6.25% (of the total Contract) must be awarded to Women Owned or Minority Businesses. This requirement must be met even if the General Contractor is certified and eligible to participate in the Small Business Set Aside Program. To facilitate compliance with this requirement for set aside subcontractors, submit a list of certified set aside contractors to be used on this project along with the dollar amounts to be paid to each, on the form provided, and a copy of their current certification must be attached. This information will be considered as part of your bid proposal and failure to comply with any portion of this requirement, including but not limited to failure to list or meet the necessary dollar amount of percentage of the bid price will be cause to reject your bid.

**F. NONDISCRIMINATION & LABOR RECRUITMENT:**

We (I) agree that the Contract awarded for this project shall be subject to the Executive Orders No. Three and Seventeen, promulgated June 16, 1971 and February 15, 1973 respectively and to the Guidelines and Rules of the State Labor Department implementing Executive Order No. Three and further agree to submit reports of Compliance Staffing on Labor Department Form E.O.3-1, when and as requested.

**G. FEDERAL & STATE WAGE DETERMINATIONS AND PRICING CONSIDERATION:**

- .1 Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes, Section 31-53 as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages".
- .2 In determining bid price, consideration should be given to Section 31-53 of the General Statutes of Connecticut as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages". Such prevailing wage adjustment will not be considered a basis for an annual contract adjustment.
- .3 The State of Connecticut Labor Department Wage Schedule where required, shall be provided with these documents, typically with the Bidders' Convenience Package, or will be incorporated in the Contract Documents as an Addendum. At the time of bidding, the bidder agrees to accept the current prevailing wage scale, as well as any annual adjustment to the prevailing wage scale, as provided by the Connecticut Department of Labor. Wage Rates will be posted each July 1st on the Department of Labor website: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us) . Such prevailing wage adjustment will not be considered a basis for an annual contract amendment.

**H. CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY & NON-SEGREGATED FACILITIES:**

We (I) acknowledge that we (I) and our subcontractors are obligated to fill out the forms provided by the University of Connecticut Office of Capital Project and Contract Administration and to agree to certify to the compliance of non-segregated facilities.

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

I. NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OR CAMPAIGN CONTRIBUTION AND SOLICITATION BAN.

With regard to a State contract as defined in P.A. 07-1 having a value in a contract year of \$50,000 or more or a combination or series of such agreements or contracts having a value of \$100,000 or more, the authorized signatory to this submission in response to the State's solicitation expressly acknowledges receipt of the State Elections Enforcement Commission's notice advertising prospective principals of the contents of the notice. See Attachment SEEC Form 11.

4. ACCOMPANYING THIS PROPOSAL IS:

A. A CERTIFIED CHECK drawn to the order of the University of Connecticut in the amount of 10% of the Bid, i.e.:

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

and drawn on the \_\_\_\_\_  
(STATE BANK & TRUST COMPANY)

\_\_\_\_\_ located at \_\_\_\_\_  
(A NATIONAL BANKING ASSOCIATION) (CITY & STATE)

which is understood shall be cashed and the proceeds thereof used so far as may be necessary to reimburse the State of Connecticut for losses and damages arising by virtue of my (our) failure to file the required Bonds and execute the required contract in this proposal as accepted by the University of Connecticut.

**OR;**

B. A BID BOND having as surety thereto a Surety Company for Companies authorized to transact business in the State of Connecticut and made out in the penal sum of 10% of the bid, (Bids \$50,000 and greater) i.e.:

\_\_\_\_\_ DOLLARS \$ \_\_\_\_\_

If the bidder is a joint venture, the Bid Bond shall specifically identify and include each joint venturer as a principal.

C. If the bidder is a joint venture, a copy of the executed Joint Venture Agreement shall be submitted along with the bid materials.

5. We (I), the undersigned, hereby declare that I am (we are) the only person(s) interested in the proposal and that it is without any connection with any other person making any bid for the same work. No person acting for, or employed by, the State of Connecticut is directly interested in this proposal, or in any contract which may be made under it, or in expected profits to arise therefrom. This proposal is made without directly or indirectly influencing or attempting to influence any other person or corporation to bid or refrain from bidding or to influence the amount of the bid of any other person or corporation. This proposal is made in good faith without collusion or connection with any other person bidding for the same work and this proposal is made with distinct reference and relation to the plans and specifications prepared for this Contract. I (We) further declare that in regard to the conditions affecting the work to be done and the labor

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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and materials needed, this proposal is based solely on my (our) investigation and research and not in reliance upon any representations of any employee, officer or agent of the State.

6. Each class of work set forth in a separate Section of the Specifications and designated as a subtrade in Item 2A of the proposal pages shall be the matter of a subcontract made in accordance with the procedures set forth in the Bid and Contract Documents.
7. The undersigned agrees that, if selected as General Contractor, he shall, within ten (10) days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the University of Connecticut, execute a contract in accordance with the terms of this general bid.
8. The undersigned agrees and warrants that he has made good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials under such contract and shall provide the Commission on Human Rights and Opportunities with such information as is requested by the Commission concerning his employment practices and procedures as they relate to the provisions of the Connecticut General Statutes governing contract requirements.
9. The undersigned acknowledges that should their submitted Form of Proposal fail to have included a copy of your firms prequalification certificate and an updated statement accompany their bid submission, that their bid will be invalid and considered non-responsive. Per CGS 4b-91 amended.

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**A. STANDARD BID BOND:**

**NOW ALL MEN BY THESE PRESENTS,**

That we, \_\_\_\_\_ hereinafter called the principal, of \_\_\_\_\_, as principal, and \_\_\_\_\_, hereinafter called the Surety, a corporation organized and existing under the laws of the State of \_\_\_\_\_, and duly authorized to transact a surety business in the State of Connecticut, as Surety, are held and firmly bound unto the State of Connecticut, as obligee, in the penal sum of ten (10) percent of the amount of the bid set forth in a proposal hereinafter mentioned, \_\_\_\_\_, in lawful money of the United States of America, for the payment of which sum, well and truly to be made to the Obligee, the Principal and the Surety bind, themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH,**

That, whereas the Principal has submitted or is about to submit a proposal the other obligee related to a contract for the Project Referenced above.

**NOW, THEREFORE,** if the said contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter in the said contract in writing with the State of Connecticut and give the required bonds, with surety acceptable to the Obligee, or if the Principal shall fail to do so, pay to Obligee the damages which the Obligee may suffer by reason of such failure not exceeding the penal sum of this bond, then this obligation shall be void, otherwise to remain in full force and effect.

SIGNED, SEALED AND DATED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

**UNIVERSITY OF CONNECTICUT  
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**FORM OF PROPOSAL**

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**B.** The undersigned proposes to furnish all labor and material required for:

**CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**University of Connecticut  
Storrs, CT**

in accordance with the accompanying Drawings and Specifications prepared by:

**RMF Engineering**

The Contract Price specified below subject to additions and deductions according to the terms of the Contract Documents.

**C. BID CLARIFICATIONS:**

The undersigned acknowledges receipt of the following Bid Clarifications issued during the bidding period and has included all changes therein in the above base bid amount.

Clarifications/Addenda # \_\_\_\_\_, Dated \_\_\_\_\_

**D. PROPOSED BASE CONTRACT PRICE:**

Having carefully examined the Bid Documents for the above reference project, and having visited the project site and examined all conditions affecting the work, the undersigned, upon written notice of award of contract, agrees to provide all labor, supervision, materials, tools, construction equipment, services, safety, insurance, bonds, and to pay all applicable taxes, and other costs necessary or required to complete the Work of this Bid in full accordance with all Bid Documents and within the required timeframe as indicated by the proposed schedule for the Lump Sum Bid of:

\_\_\_\_\_ **US Dollars**

**(\$ \_\_\_\_\_) (which incorporates all allowances as may be listed in the plans and specifications)**

**(Show the amount in both words and figures. In case of discrepancy, amount shown in words will govern.)**

The University reserves the right to elect to implement some, all or none of the Alternates and/or Options set forth in the Proposal forms, as may be in the best interest of the University. The low Bid shall be determined by taking the Base Price set forth in the Proposal form as selected by the University, plus the Alternates and/or Options selected by the University.

**E. SCHEDULE OF ALTERNATES: (Not Used)**

Provide Alternate Prices which reflect the work of the bid package under which this bid proposal was submitted and shall remain ***valid for the life of the project*** and include **all costs** for a complete installation. All pricing is inclusive of all costs of wages, applicable taxes, benefits, and applicable insurance. The Prices herein shall remain valid for the life of the project and include all costs for a complete installation. Alternate prices are good for both adds and deducts.

**END OF ALTERNATES**

**UNIVERSITY OF CONNECTICUT  
 CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
 #901696**

**FORM OF PROPOSAL**

**F. SCHEDULE OF UNIT PRICES: (Not Used)**

All rates are inclusive of all costs of wages, applicable taxes, benefits, applicable insurance. The rates provided will be negotiated and included as part of the contract and of your subcontracts. The Unit Prices herein shall remain valid for the life of the project and include all costs for a complete installation. Unit prices are good for both adds and deducts.

<u>Unit Price</u>	<u>Description</u>	<u>Unit of Measurement</u>	<u>Add/Deduct Rate</u>

End of Unit Prices

UNIVERSITY OF CONNECTICUT  
 CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
 #901696

FORM OF PROPOSAL

G. SCHEDULE OF LABOR RATES:

The following are hourly wage rates for all tradesmen associated with this project for performing extra work. These rates are fully loaded (including benefits, applicable taxes, and worker compensation insurance) and are in accordance with the prevailing wages of the trade having jurisdiction in areas where the work is performed. The wage rates shall be valid for the life of the project. ***NOTE: Further, no mark-up shall be allowed on the premium time portion of the wage rate. At the request of the University, the Contractor will submit labor rate summary sheets, which justify all submitted labor rates. All rates are subject to thorough analysis and subject to reduction if deemed inaccurate by The University of Connecticut.***

TRADE: \_\_\_\_\_

Attachments: Y / N

Submit one sheet for each Labor Trade (Division) used on project. Copy as needed.

<u>Foreman</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Journeyman</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Apprentice</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

<u>Laborer</u>	<u>Straight Time</u>	<u>Time and One Half</u>	<u>Double Time</u>
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____
_____	\$ _____	\$ _____	\$ _____

End Labor Rates

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**H. SCHEDULE OF VALUES:**

The undersigned agrees that the Schedule of Values submitted with this Bid is a true representation of the distribution of the costs of this project and equals the Stipulated Sum shown above. The Schedule of Values is an integral part of this proposal. Please indicate N/A for those divisions of work not applicable. The costs provided below include the complete cost for furnishing and installing of materials, labor, and equipment required to provide the complete scope of work for each specified division (includes the costs of applicable taxes, insurance, bonds, overhead, profit, small tools, travel, parking, supervision, etc.). The "TOTAL" price must equal your total lump sum bid proposal.

Division 1, General Conditions/Requirements	\$ _____
Division 2, Existing Conditions	\$ _____
Division 3, Concrete	\$ _____
Division 4, Masonry	\$ _____
Division 5, Metals	\$ _____
Division 6, Wood, Plastics and Composites	\$ _____
Division 7, Thermal and Moisture Protection	\$ _____
Division 8, Openings	\$ _____
Division 9, Finishes	\$ _____
Division 10, Specialties	\$ _____
Division 11, Equipment	\$ _____
Division 12, Furnishings	\$ _____
Division 13, Special Construction	\$ _____
Division 14, Conveying Equipment	\$ _____
Division 15 through 20 Not Used	
Division 21 Fire Suppression	\$ _____
Division 22 Plumbing	\$ _____
Division 23 Heating, Ventilating & Air Conditioning	\$ _____
Division 24 Not Used	
Division 25 Integrated Automation	\$ _____
Division 26 Electrical	\$ _____
Division 27 Communications	\$ _____
Division 28 Electronic Safety & Security	\$ _____
Division 29 and 30 Not Used	
Division 31 Earthwork	\$ _____
Division 32 Exterior Improvements	\$ _____
Insurance	\$ _____
Bonds	\$ _____
Allowances (where applicable)	\$ _____
<b>TOTAL</b>	<b>\$ _____</b>

**UNIVERSITY OF CONNECTICUT  
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**FORM OF PROPOSAL**

**I. The subdivision of Work in the proposed Contract Price is as follows:**

**ITEM 1 WORK BY GENERAL CONTRACTOR:**

For all work other than that to be done by subcontractors included in Item 2A and Item 2B.

\$ \_\_\_\_\_ **(ITEM 1)**

**Note:** In accordance with paragraph 3.E.1 this amount, together with work by the general contractor as listed in Item 2A below, must be at least 10% of the total bid price.

**ITEM 2A WORK BY SUBCONTRACTORS NAMED:**

Subcontractors and prices for the following trades must be listed (if such prices exceed \$25,000). However, the general bidder may list himself together with his price if he customarily performs any of the trades specified. If the general contractor requires a performance and/or labor & material payment bond then the general contractor must indicate below which of the subcontractors are subject to this requirement. The amount (%) shall not exceed the subcontractor's price listed below.

DESCRIPTION	NAME OF SUBCONTRACTOR	DOLLAR AMOUNT	LABOR & MATERIAL BOND	PERFORMANCE BOND
MASONRY				
ELECTRICAL				
MECHANICAL WITHOUT HVAC				
HVAC				

**A copy of the executed agreement between the successful bidder and the named subcontractors above must be presented to the Office of CPCA at time of contract signing. The contract may not be executed until copies of executed agreements are received by CPCA.**

**ITEM 2B WORK BY SUBCONTRACTORS NOT NAMED:**

\$ \_\_\_\_\_  
**(INCLUDES ALL SUBCONTRACT WORK NOT LISTED IN ITEM 2A)**

The undersigned agrees that each of the subcontractors listed on this FORM OF PROPOSAL will be used for the work indicated at the amount stated, unless a substitution is permitted by the University.

**UNIVERSITY OF CONNECTICUT  
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#901696**

**FORM OF PROPOSAL**

**J. SET-ASIDE CONTRACTOR SCHEDULE**

In accordance with Section 5.2 of our Notice and Instructions to Bidders, it is a requirement to list below the names of each currently certified set aside contractor anticipated to be used for this project, along with the dollar amount to be paid each contractor.

The responsibility for listing a qualified and certified set aside contractor, Women Owned Businesses or Minority Businesses, rests solely with the proposer and not the State. **We acknowledge that listing a subcontractor who does not qualify shall be considered the same as not listing one at all and the proposal may be considered non-responsive and subject to rejection.**

<u>Name</u>	<u>Address</u>	<u>Amount</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

The amount is NOT LESS THAN 25% of the proposed base contract price as stated on the Form of Proposal, Section D.

**CERTIFICATE OF ELIGIBILITY HAS BEEN OBTAINED THROUGH THE FOLLOWING WEBSITE;  
<https://www.biznet.ct.gov/SupplierDiversity/SDSearch.aspx>  
FOR EACH OF THE NAMED CONTRACTORS AND IS BEING SUBMITTED WITH THIS FORM.**

The Undersigned agrees that each of the subcontractors listed on the proposal form will be used for the work indicated at the amount stated, unless a substitution is permitted by the awarding authority.

\_\_\_\_\_  
Authorized Signature Title

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

**K. BIDDER CONTRACT COMPLIANCE MONITORING REPORT**

**PART I - Bidder Information**

Company Name Street Address City & State Chief Executive	Bidder Federal Employer Identification Number _____ Or Social Security Number _____
Major Business Activity (brief description)	Bidder Identification (response optional/definitions in Instruction to Bidders page 18)  -Bidder is a small contractor. Yes__ No__  -Bidder is a minority business enterprise Yes__ No__ (If yes, check ownership category)  Black__ Hispanic__ Asian American__ American Indian/Alaskan Native ____ Iberian Peninsula__ Individual(s) with a Physical Disability__ Female__
Bidder Parent Company(If any)	-Bidder is certified as above by State of CT Yes__ No__ -
Other Locations in Ct. (If any)	DAS                      Certification                      Number _____

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**PART II - Bidder Nondiscrimination Policies and Procedures**

<p>1. Does your company have a written Affirmative Action/Equal Employment Opportunity statement posted on company bulletin boards? Yes__ No__</p>	<p>7. Do all of your company contracts and purchase orders contain non-discrimination statements as required by Sections 4a-60 &amp; 4a-60a Conn. Gen. Stat.? Yes__ No__</p>
<p>2. Does your company have the state-mandated sexual harassment prevention in the workplace policy posted on company bulletin boards? Yes__ No__</p>	<p>8. Do you, upon request, provide reasonable accommodation to employees, or applicants for employment, who have physical or mental disability? Yes__ No__</p>
<p>3. Do you notify all recruitment sources in writing of your company's Affirmative Action/Equal Employment Opportunity employment policy? Yes__ No__</p>	<p>9. Does your company have a mandatory retirement age for all employees? Yes__ No__</p>
<p>4. Do your company advertisements contain a written statement that you are an Affirmative Action/Equal Opportunity Employer? Yes__ No__</p>	<p>10. If your company has 50 or more employees, have you provided at least two (2) hours of sexual harassment training to all of your supervisors? Yes__ No__ NA__</p>
<p>5. Do you notify the Ct. State Employment Service of all employment openings with your company? Yes__ No__</p>	<p>11. If your company has apprenticeship programs, do they meet the Affirmative Action/Equal Employment Opportunity requirements of the apprenticeship standards of the Ct. Dept. of Labor? Yes__ No__ NA__</p>
<p>6. Does your company have a collective bargaining agreement with workers? Yes__ No__</p> <p>6a. If yes, do the collective bargaining agreements contain non-discrimination clauses covering all workers? Yes__ No__</p> <p>6b. Have you notified each union in writing of your commitments under the nondiscrimination requirements of contracts with the state of Ct? Yes__ No__</p>	<p>12. Does your company have a written affirmative action Plan? If no, please explain. Yes__ No__</p>
	<p>13. Is there a person in your company who is responsible for equal employment opportunity? Yes__ No__ If yes, give name and phone number. _____ _____</p>

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**Part III - Bidder Subcontracting Practices**

1. Will the work of this contract include subcontractors or suppliers? Yes\_\_ No\_\_  
 1a. If yes, please list all subcontractors and suppliers and report if they are a small contractor and/or a minority business enterprise as defined on page 1 / use additional sheet if necessary)  
 1b. Will the work of this contract require additional subcontractors or suppliers other than those identified in 1a? Yes\_\_ No\_\_

**Part IV – Bidder Employment Information**

Date:

JOB CATEGORY	OVERALL TOTALS	WHITE (not of Hispanic origin)		BLACK (not of Hispanic origin)		HISPANIC		ASIAN or PACIFIC ISLANDER		AMERICAN INDIAN or ALASKAN NATIVE	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Management											
Business & Financial Ops											
Computer Specialists											
Architecture/Engineering											
Office & Admin Support											
Bldg/ Grounds Cleaning/Maintenance											
Construction & Extraction											
Installation, Maintenance & Repair											
Material Moving Workers											
TOTALS ABOVE											
Total One Year Ago											
FORMAL ON THE JOB TRAINEES (ENTER FIGURES FOR THE SAME CATEGORIES AS ARE SHOWN ABOVE)											
Apprentices											
Trainees											

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**PART V - Bidder Hiring and Recruitment Practices**

1. Which of the following recruitment sources are used by you? (check yes or not and report percent used)				2. Check (x) any of the below listed requirements that you use as a hiring qualification		3. Describe below any other practices or actions that you take which show that you hire, train, and promote employees without discrimination?
SOURCE	YES	NO	% of applicants provided by source	(x)		
State Employment Service					Work Experience	
Private Employment Agencies					Ability To Speak Or Write English	
Schools And Colleges					Written Tests	
Newspaper Advertisements					High School Diploma	
Walk Ins					College Degree	
Present Employees					Union Membership	
Labor Organizations					Personal Recommendations	
Minority/Community Organizations					Height Or Weight	
Others Please Identify					Car Ownership	
					Arrest Record	
					Wage Garnishments	

Certification (Read this form and check your statements on it CAREFULLY before signing).

I certify that the statements made by me on this BIDDER CONTRACT COMPLIANCE MONITORING REPORT are complete and true to the best of my knowledge and belief, and are made in good faith. I understand that if I knowingly make any misstatements of facts, I am subject to be declared in non-compliance with Section 4a-60, 4a-60a, and related sections of the CONN. GEN. STAT.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date Signed)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Telephone)

# CODE OF CONDUCT FOR UNIVERSITY OF CONNECTICUT VENDORS

The University of Connecticut (“UConn”) has a longstanding commitment to the protection and advancement of socially responsible practices that reflect respect for fundamental human rights and the dignity of all people. UConn strives to promote basic human rights and appropriate labor standards for all people throughout its supply chain. Promoting these values in concrete practice is the central charge of the President’s Committee on Corporate Social Responsibility (<http://csr.uconn.edu/>).

UConn is also committed to building a safe, healthy and sustainable environment through the conservation of natural resources, increasing its use of environmentally responsible products, materials and services (including renewable resources), and preventing pollution and minimizing waste through reduction, reuse and recycling. UConn is proactive about purchasing products that have these environmental attributes or meet recognized environmental standards, when practicable, and buying from entities committed to the support of campus sustainability goals. The University seeks to partner and contract with vendors that demonstrate a similar commitment to these values. Selected vendors may be required to provide a comprehensive summary report of their corporate social and environmental practices.

## **Principal Expectations**

The principal expectations set forth below reflect the minimal standards UConn's vendors are required to meet.

**Nondiscrimination.** It is expected that vendors will not discriminate in hiring, employment, salary, benefits, advancement, discipline, termination or retirement on the basis of race, color, religion, gender, nationality, ethnicity, alienage, age, disability or marital status, and will comply with all federal nondiscrimination laws and state nondiscrimination laws<sup>1</sup>, including Chapter 814c of the Connecticut General Statutes (Human Rights and Opportunities), as applicable, and further will provide equal employment opportunity irrespective of such characteristics, including complying, if applicable, with Federal Executive Order 1124b, and the Rehabilitation Act of 1973.

**Freedom of Association and Collective Bargaining.** It is expected that vendors will respect their employees’ rights of free association and collective bargaining, including, if applicable, complying with the National Labor Relations Act, and, if applicable, Chapters 561 and 562 of the Connecticut General Statutes (Labor Relations Act, Labor Disputes) and Chapters 67 and 68 of the Connecticut General Statutes (State Personnel Act, Collective Bargaining for State Employees).

**Labor Standard Regarding Wages, Hours, Leaves and Child Labor.** It is expected that vendors will respect their employees’ rights regarding minimum and prevailing wages, payment of wages, maximum hours and overtime, legally mandated family, child birth and medical leaves, and return to work thereafter, and limitations on child labor, including, if applicable, the

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<sup>1</sup> Wherever this code refers to compliance with federal or state laws, that term includes compliance with any regulations duly promulgated pursuant to such laws.

rights set forth in the Federal Fair Labor Standards Act, the Federal Family and Medical Leave Act, the Federal Davis-Bacon Act and Chapters 557 and 558 of the Connecticut General Statutes (Employment Regulation, Wages).

**Health and Safety.** It is expected that vendors will provide safe and healthful working and training environments in order to prevent accidents and injury to health, including reproductive health, arising out of or related to or occurring during the course of the work vendors perform or resulting from the operation of vendors' facilities. Accordingly, it is expected that vendors and their subcontractors will perform work pursuant to UConn contracts in compliance with, as applicable, the Federal Occupational Safety and Health Act and Chapter 571 of the Connecticut General Statutes (Occupational Safety and Health Act).

**Forced Labor.** It is expected that vendors will not use or purchase supplies or materials that are produced using any illegal form of forced labor.

**Harassment or Abuse.** It is expected that vendors will treat all employees with dignity and respect, and that no employee will be subjected to any physical, sexual, psychological or verbal abuse or harassment. It is further expected that vendors will not use or tolerate the use of any form of corporal punishment.

**Environmental Compliance.** It is expected that vendors will comply with all applicable federal and state environmental laws and Executive Orders, including but not limited to Titles 22a and 25 of the Connecticut General Statutes (Environmental Protection and Water Resources protection) and Executive Order 14 (concerning safe cleaning products and services). UConn expects vendors will employ environmentally responsible practices in the provision of their products and services.

### **Preferential Standards**

The preferential standards set forth below reflect UConn's core values. UConn will seek to uphold these values by considering them as relevant factors in selecting vendors.

**Living Wages.** UConn recognizes and affirms that reasonable living wages are vital to ensuring that the essential needs of employees and their families can be met, and that such needs include basic food, shelter, clothing, health care, education and transportation. UConn seeks to do business with vendors that provide living wages so as to meet these basic needs, and further recognizes that compensation may need to be periodically adjusted to ensure maintenance of such living wages. Vendors are encouraged to demonstrate that they pay such living wages.

**International Human Rights.** For UConn, respect for human rights is a core value. UConn seeks to do business with vendors who do not contribute to or benefit from systemic violations of recognized international human rights and labor standards, as exemplified by the Universal Declaration of Human Rights.

**Foreign Law.** UConn encourages vendors and vendors' suppliers operating under foreign law to comply with those foreign laws that address the subject matters of this code, provided such foreign laws are consistent with this code. Vendors and their suppliers operating under foreign law are similarly encouraged to comply with the provisions of this code to the extent they can do so without violating the foreign law(s) they operate under.

**Environmental Sustainability.** UConn will prefer products and services that conserve resources, save energy and use safer chemicals, such as recycled, recyclable, reusable, energy efficient, carbon-neutral, organic, biodegradable or plant-based, in addition to products that are durable and easily repairable, and that meet relevant certification standards above and beyond those required by law. While UConn is not legally bound to comply with Connecticut General Statutes 4a-67a through 4a-67h concerning environmental sustainability standards in purchasing, it will nevertheless consider vendors' ability to meet those standards in rendering its purchasing decisions. Vendors are encouraged to demonstrate their commitment to environmental sustainability.

**Compliance Procedures**

Anyone who believes a vendor doing business with UConn has not complied or is not complying with this code may report such concerns to UConn's Office of Audit, Compliance and Ethics (OACE) at 1-888-685-2637 or <https://www.compliance-helpline.com>.

OACE has the authority to investigate such matters, and if warranted, recommend remedial action to the UConn administration.

Please review the material listed and per the signature of the authorized Company Official, all Expectations, Standards, and Procedures listed above will be in compliance in regards to this Contract.

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Name of Company

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Signature of Authorized Company Official

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Date

## Connecticut Economic Impact Form

This form is intended to gather general Connecticut economic impact information from prospective suppliers. This form shall be updated with each solicitation. This form is for informational gathering purposes only and will not be used in the evaluation of a prospective supplier's qualifications.

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

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

Location (City, State) of Principal Place of Business: \_\_\_\_\_

\_\_\_\_\_

Date Registered to do Business in Connecticut: \_\_\_\_\_

Number of Connecticut Locations: \_\_\_\_\_

Number of Connecticut Employees: \_\_\_\_\_

Annual Payroll Paid to Connecticut State Residents: \_\_\_\_\_

Annual Taxes, Licenses, Fees Paid to Connecticut (this may be payroll, franchise, service taxes, etc.): \_\_\_\_\_

Annual Rent Paid within Connecticut or value of Real Property: \_\_\_\_\_

Annual Utilities Paid within Connecticut: \_\_\_\_\_

Amount paid to Major partners or suppliers in Connecticut: \_\_\_\_\_

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

**L. PROPOSER'S QUALIFICATION/RESPONSIBILITY STATEMENT**

The Proposer shall have already completed and submitted the Questionnaire and other submission required by the University in its Invitation to Pre-Qualify, regarding the Proposer's qualifications. If changed circumstances arising since the initial submission, or other facts have occurred which would result in a material change to any of the Proposer's initial responses or submissions, the Proposer shall provide any such supplementary, or revised information at this time, along with its Proposal.

1. State, identify any such changed circumstances or other facts and provide any such supplementary or revised information as described above, identifying specifically, by number and content, each prior question, response to the Questionnaire, or information changed, supplemented or revised. (Attach a separate sheet if necessary)
2. State "NONE" if there are no changes to be made. \_\_\_\_\_

Please note that if the end date of the time period covered by the information submitted during your pre-qualification is three or more months old, please provide current financial documentation demonstrating that your present financial position has remained the same, or showing and identifying any changes in any way, in relation to the audited financial statement you submitted with your pre-qualified application on this proposal.

Dated at	this	day of	20
Name of Organization:			
Signature:			
Print Name:			
Title:			
<b><u>Notary Statement:</u></b>			
Mr./Mrs./Ms.		being duly sworn deposes and says that he/she	
is the	of	and that the	
(Position or Title)		(Firm Name)	
answers to the foregoing questions and all statements therein contained are true and correct.			
Subscribed and sworn to before me this		day of	20
Notary Public:			
My Commission Expires:		20	

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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M. ETHICS FORMS - A duly authorized representative of the company must sign these forms

- √ **These forms must be notarized and clearly show notary seal or acknowledged by a Commissioner of the Superior Court.**
  
- √ ALL REQUIRED forms, **must be completed, signed and returned** by the bidder/proposer as part of the bid/proposal/RFQ response package.
  
- √ Failure to submit ALL REQUIRED forms constitutes grounds for rejection of your bid/proposal/RFQ.
  
- √ If it is determined by the University of Connecticut and/or State of Connecticut that **any information requested was not referenced and submitted** with this bid/proposal/RFQ/LOI, and then such determination **will be just cause for disqualification of the bid/proposal/RFQ.**

OPM Ethics Form 5  
Rev. 10-01-11



STATE OF CONNECTICUT  
CONSULTING AGREEMENT AFFIDAVIT

*Affidavit to accompany a bid or proposal for the purchase of goods and services with a value of \$50,000 or more in a calendar or fiscal year, pursuant to Connecticut General Statutes §§ 4a-81(a) and 4a-81(b). For sole source or no bid contracts the form is submitted at time of contract execution.*

**INSTRUCTIONS:**

**If the bidder or vendor has entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete all sections of the form. If the bidder or contractor has entered into more than one such consulting agreement, use a separate form for each agreement. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public. **If the bidder or contractor has not entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete only the shaded section of the form. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public.

Submit completed form to the awarding State agency with bid or proposal. For a sole source award, submit completed form to the awarding State agency at the time of contract execution.

This affidavit must be amended if there is any change in the information contained in the most recently filed affidavit not later than (i) thirty days after the effective date of any such change or (ii) upon the submittal of any new bid or proposal, whichever is earlier.

**AFFIDAVIT:** [Number of Affidavits Sworn and Subscribed On This Day: \_\_\_\_\_]

I, the undersigned, hereby swear that I am a principal or key personnel of the bidder or contractor awarded a contract, as described in Connecticut General Statutes § 4a-81(b), or that I am the individual awarded such a contract who is authorized to execute such contract. I further swear that I have not entered into any consulting agreement in connection with such contract, **except for the agreement listed below:**

_____		_____
Consultant's Name and Title		Name of Firm (if applicable)
_____	_____	_____
Start Date	End Date	Cost
Description of Services Provided: _____		
_____		
_____		

Is the consultant a former State employee or former public official?  YES  NO

If YES: \_\_\_\_\_  
Name of Former State Agency Termination Date of Employment

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____	_____	_____
Printed Name of Bidder or Contractor	Signature of Principal or Key Personnel	Date
_____		_____
Printed Name (of above)		Awarding State Agency

Sworn and subscribed before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Commissioner of the Superior Court  
or Notary Public

OPM Ethics Form 6  
Rev. 10-01-11



**STATE OF CONNECTICUT**  
**AFFIRMATION OF RECEIPT OF STATE ETHICS LAWS SUMMARY**

*Written or electronic affirmation to accompany a large State construction or procurement contract, having a cost of more than \$500,000, pursuant to Connecticut General Statutes §§ 1-101mm and 1-101qq*

**INSTRUCTIONS:**

Complete all sections of the form. Submit completed form to the awarding State agency or contractor, as directed below.

**CHECK ONE:**

- I am a person seeking a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency with my bid or proposal. [Check this box if the contract will be awarded through a competitive process.]
- I am a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency at the time of contract execution. [Check this box if the contract was a sole source award.]
- I am a subcontractor or consultant of a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the contractor.
- I am a contractor who has already filed an affirmation, but I am updating such affirmation either (i) no later than thirty (30) days after the effective date of any such change or (ii) upon the submittal of any new bid or proposal, whichever is earlier.

**IMPORTANT NOTE:**

Within fifteen (15) days after the request of such agency, institution or quasi-public agency for such affirmation contractors shall submit the affirmations of their subcontractors and consultants to the awarding State agency. Failure to submit such affirmations in a timely manner shall be cause for termination of the large State construction or procurement contract.

**AFFIRMATION:**

I, the undersigned person, contractor, subcontractor, consultant, or the duly authorized representative thereof, affirm (1) receipt of the summary of State ethics laws\* developed by the Office of State Ethics pursuant to Connecticut General Statutes § 1-81b and (2) that key employees of such person, contractor, subcontractor, or consultant have read and understand the summary and agree to comply with its provisions.

\* The summary of State ethics laws is available on the State of Connecticut's Office of State Ethics website.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Firm or Corporation (if applicable)

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

\_\_\_\_\_  
Awarding State Agency



**STATE OF CONNECTICUT**  
**NONDISCRIMINATION CERTIFICATION – Affidavit**  
**By Entity**  
**For Contracts Valued at \$50,000 or More**

*Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson, member, or other corporate officer duly authorized to adopt corporate, company, or partnership policy that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended*

**INSTRUCTIONS:**

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at \$50,000 or more for any year of the contract. Complete all sections of the form. Sign form in the presence of a Commissioner of Superior Court or Notary Public. Submit to the awarding State agency prior to contract execution.

**AFFIDAVIT:**

I, the undersigned, am over the age of eighteen (18) and understand and appreciate the obligations of

an oath. I am \_\_\_\_\_ of \_\_\_\_\_, an entity  
Signatory's Title Name of Entity

duly formed and existing under the laws of \_\_\_\_\_.  
Name of State or Commonwealth

I certify that I am authorized to execute and deliver this affidavit on behalf of

\_\_\_\_\_ and that \_\_\_\_\_  
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

\_\_\_\_\_  
Authorized Signatory

\_\_\_\_\_  
Printed Name

Sworn and subscribed to before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Commissioner of the Superior Court/  
Notary Public

\_\_\_\_\_  
Commission Expiration Date



**STATE OF CONNECTICUT**

Written or electronic PDF copy of the written certification to accompany a large state contract pursuant to P.A. No. 13-162 (Prohibiting State Contracts With Entities Making Certain Investments In Iran)

**Respondent Name:** \_\_\_\_\_

**INSTRUCTIONS:**

- CHECK ONE:**  Initial Certification  
 Amendment or renewal

**A. Who must complete this certification pursuant to P.A. No. 13-162.** Prior to submitting a bid proposal, or, if there was no bid process, prior to executing a contract, for all large state contracts, this certification must be completed by any corporation, general partnership, limited partnership, limited liability partnership, joint venture, nonprofit organization or other business organization **whose principal place of business is located outside of the United States** ("Respondent"). United States subsidiaries of foreign corporations are exempt. For purposes of this Certification, a "foreign corporation" is one that is organized and incorporated outside the United States of America.

**Check applicable box:**

- Respondent's principal place of business is within the United States or Respondent is a United States subsidiary of a foreign corporation. Respondents who check this box **are not required to complete the remainder of the certification**, but must submit this certification with its Invitation to Bid ("ITB"), Request for Proposal ("RFP") or contract package if there was no bid process.
- Respondent's principal place of business is outside the United States and it is not a United States subsidiary of a foreign corporation. **CERTIFICATION required.** Please complete the remainder of the certification and submit it with the ITB or RFP response or contract package if there was no bid process.

**B. Additional definitions.**

- 1) "Large State Contract" has the same meaning as provided in section 4-250 of the Connecticut General Statutes; and
- 2) "State agency" and "quasi-public agency" have the same meanings as provided in section 1-79 of the Connecticut General Statutes.

**C. Certification requirements.**

No state agency or quasi-public agency shall enter into any large state contract, or amend or renew any such contract with any Respondent unless the Respondent has submitted this certification.

Complete all sections of this certification and sign and date it, under oath, in the presence of a Commissioner of the Superior Court, a Notary Public or a person authorized to take an oath in another state.

**CERTIFICATION:**

I, the undersigned, am the official authorized to execute contracts on behalf of the Respondent. I certify that:

Respondent has made no direct investments of twenty million dollars or more in the energy sector of Iran on or after October 1, 2013, as described in Section 202 of the Comprehensive Iran Sanctions, Accountability and Divestment Act of 2010.

Respondent has either made direct investments of twenty million dollars or more in the energy sector of Iran on or after October 1, 2013, as described in Section 202 of the Comprehensive Iran Sanctions, Accountability and Divestment Act of 2010, or Respondent made such an investment prior to October 1, 2013 and has now increased or renewed such an investment on or after said date, or both.

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

\_\_\_\_\_  
**Printed Respondent Name**

\_\_\_\_\_  
**Printed Name of Authorized Official**

\_\_\_\_\_  
**Signature of Authorized Official**

**Subscribed and acknowledged before me this \_\_day of \_\_\_\_\_, 20\_\_.**

\_\_\_\_\_  
**Commissioner of the Superior Court (or Notary Public)**

**UNIVERSITY OF CONNECTICUT  
CENTRAL UTILITY PLANT UPGRADE CHILLED WATER SYSTEM  
#901696**

**FORM OF PROPOSAL**

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**All pages within the Form of Proposal must be completed, signed by a duly authorized representative of the firm and returned as part of the bid/proposal/RFQ response package. NO FACSIMILE SIGNATURE PERMITTED**

- √ **If the form of proposal is being submitted by a Joint Venture, each Joint Venture shall sign the Proposal, and each Joint Venture agrees to be bound by the terms and conditions thereof.**
- √ **Failure to submit ALL REQUIRED forms constitutes grounds for rejection of your bid/proposal/RFQ.**
- √ **If it is determined by the University of Connecticut and/or State of Connecticut that any information requested but not referenced and submitted with this bid/proposal; such determination will be just cause for disqualification of the bid/proposal.**

(TO BE FILLED IN AND SIGNED BY THE BIDDER)

Signed the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Firm Name: \_\_\_\_\_

Street: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

(TO BE FILLED IN AND SIGNED BY JOINT VENTURE IF APPLICABLE)

Firm Name: \_\_\_\_\_

Street: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

Duly Authorized/Title: \_\_\_\_\_

**End of Form of Proposal**