Omaha Public Schools
Department of District Operational Services
Purchasing Division

BID No.: 26-004
Date: July 17, 2025

Addendum No. 1
to
Bid Documents for
OPS North and Northwest High School Cooling Tower Replacement Project

The purpose of this Addendum No. 1 is to modify Bid 26-004, OPS North and Northwest High School Cooling Tower Replacement Project. Except as specifically modified by this Addendum No. 1, the Bid Documents shall remain in effect as originally issued.

The Bid Documents are hereby amended as follows:

1. **Project Document: See Updated Bid Invitation Cover Sheet.**

2. **Project Specifications: See Updated Project Specification.**

3. **Project Construction Drawings: See Updated Project Drawings.**

IMPORTANT: Applicants should acknowledge the receipt of this Addendum No. 1 by a notation in the Bid submitted by the Bidder in the manner as required by the Bid Documents.

Bid Invitation
Bid No. 26-004

TO BE CONSIDERED, BIDS MUST BE RECEIVED PRIOR TO THE DEADLINE
LATE BIDS WILL NOT BE ACCEPTED

The Board of Education for Douglas County School District 0001 (Omaha Public Schools) invites bids for:

OPS North and Northwest High School Cooling Tower Replacement Project

RETURN TO:

Omaha Public Schools
District Operational Services
3215 Cuming St., Omaha, Nebraska 68131

Bid Number	26-004
Date of Issuance of Bid	July 16, 2025
Prebid Meeting - **Mandatory**	Friday July 25, 2025 @ 9 AM CT OPS North High School 4410 N 36th St. Omaha, NE 68111
Deadline for Submission of Questions	July 31, 2025
Bid Submission Deadline	August 12, 2025
Anticipated Bid Award & Board of Education Approval Timeline	September 08, 2025
Substantial Completion of Project	December 31, 2025

Question Submission Email Box Address	Questions_Clarifications_1@ops.org
Microsoft Teams Meeting Phone Number for Bid Opening	402-509-3892
Microsoft Team Conference ID for Bid Opening	357 827 326#
Address for in Person Bid Opening	District Operational Services Purchasing Division Omaha Public Schools 3215 Cuming Street Omaha, NE 68131

Bid 26-004

OPS North and Northwest High School Cooling Tower Replacement Project

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1.0 BID INVITATION

Douglas County School District 0001 ("Omaha Public Schools"), ("OPS" or "District") invites qualified bidders to submit bids to furnish OPS with all labor, materials, tools, equipment, utility and transportation services and related work and supplies necessary for replacement of the cooling tower at North High School, 4410 N 36th St, and at Northwest High School, 8204 Crown Point. The work includes, but is not limited to, demolition, electric, controls, structural, mechanical, and plumbing required to replace two existing cooling towers, one at each school, (referred to herein as "the Project" and may also be referred to as "the Work") in accordance with the following bid specifications and plans developed by the District and BDH Engineering LLC. A more detailed description of the Work to be performed is in Section 2.0, Contract Specifications, Section 3.0, Project Drawings and Project Specifications and in Exhibits A and B below. Bids must be completed on the bid form provided in the Bid Documents and submitted in accordance with the requirements stated in these Bid Documents. For purposes of this Bid, the term "Bid Documents" include the following documents: Bid Invitation, the Contract Specifications, the Project Drawings and Project Specifications, the Bid Submission Instructions and Requirements, the General Terms and Conditions, the Bid Form and Signature Page, Exhibits A, Project Specifications and Exhibit B Project Drawings and any Addenda issued prior to bid opening. The Bid Documents are not complete unless all of these documents are included. Bidders should review all the Bid Documents carefully before submitting a bid proposal since these Bid Documents, along with other documents that are referred to in the Bid Documents, will be incorporated into and will become a part of any Purchase Order or Contract (as hereinafter defined) between OPS and a successful bidder for the Work.

Please note the mandatory pre-bid meeting requirement for all potential bidders. See Section 4.4 below.

Submit bids in a sealed opaque envelope or container clearly marked on the exterior of the envelope or container with the information listed below:

BID No. 26-004, **OPS North and Northwest High School Cooling Tower Replacement Project**

Address for submission of bids:

Omaha Public Schools
District Operational Services
3215 Cuming St.
Omaha, NE 68131

Hand-delivered bids shall be brought to the Security Desk at the East Entrance on the Ground Floor of the Teacher Administrative Center (TAC) at the above address.

2.0 CONTRACT SPECIFICATIONS

2.1 SPECIFICATIONS & SCOPE OF WORK

The Work called for in these Bid Documents includes the replacement of two existing cooling towers for the two schools. The North High school cooling tower is a 1,000 Ton 2-cell cooling tower located on a ground level tower enclosure connected to the school and adjacent to the street. The Northwest High School cooling tower is a 700 Ton single cell cooling tower located in a free standing cooling tower enclosure in a grassy area south of the school. The work encompasses all mechanical, plumbing, electrical, controls and structural to provide a complete and working cooling tower system.

In general, all materials and equipment to be furnished by Contractor must be of good quality, new and unused, undamaged, and shall be constructed and installed as required in the Contract Documents and of the types of equipment and materials as specified.

It is the Contractor's responsibility to protect existing construction. In addition, daily removal of debris and repair of any damage due to work under this Contract is considered within the scope of Work and is the responsibility of the Contractor.

Contractor shall be responsible for the performance of all of the Work for the Project. Unless specifically prohibited by the Contract Documents, Contractor may retain qualified and responsible subcontractors for the performance of parts of the Work. Such subcontractors must be reasonably acceptable to the District. Contractor shall be fully responsible to District for all acts and omissions of the Contractor's subcontractors, suppliers, and other individuals or entities performing or furnishing any of the Work provided by or under the control of the Contractor, just as Contractor is responsible for Contractor's own acts and omissions. No acceptance by District of any such subcontractor, supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of District to the completion of the Work in accordance with this Contract Documents. Contractor shall be solely responsible for scheduling and coordinating the Work of subcontractors, suppliers, and all other individuals or entities performing or furnishing any of the Work, which are under the control of Contractor.

All Work must be done in accordance with best trade practices using qualified workmen. All Work shall be performed in a manner that does not void any manufacturer's warranty.

All engineering work and plan preparations for shop drawings and other Contractor submittals shall be the responsibility of the Contractor, who shall utilize qualified and licensed engineers for such work.

2.2 WORK HOURS AND WORK DAYS

With respect to Work in or in connection with OPS occupied facilities, it is expected that all Work will be performed during normal working hours (6:30 am – 5:00 pm CT) on regular working days (Monday-Friday) exclusive of District observed holidays. Should the Contractor desire to work at other times, advance requests shall be made to the project manager so that the areas can be made available. OPS personnel must be on hand at any time work is in progress at such an occupied location.

2.3 CONTRACTOR EXPERIENCE AND PROJECT STAFFING

Contractor and its personnel shall be duly licensed by the City of Omaha to perform the mechanical and electrical installation work required by the Contract with the District.

All work must be done in accordance with best trade practices using qualified workers. Qualified workers shall mean at least one (1) experienced journeyman for every two (2) workers on the job site. There shall be a minimum of three (3) workers from start of Project to completion. At all times, at least one of the Contractor's work crew must be fluent in English and able to communicate in the language of the remaining crew members.

2.4 PROJECT COMMENCEMENT, COMPLETION DATES AND LIQUIDATED DAMAGES

The performance of the Work shall commence upon receipt by Contractor of written notice to proceed from District. A notice to proceed will not be issued prior to execution of the Contract between the District and the Contractor, and in any event, not prior to September 9, 2025. Moreover, the District will not issue a notice to proceed until Contractor and the District have executed the Contract for the Project and the Contractor has furnished District with an insurance

certificate and a performance, labor, and material bond complying with the requirements of the Contract Documents.

Substantial Completion of the work shall be achieved not later than December 31, 2025. Final Completion shall be achieved not later than fourteen (14) days after Substantial Completion is achieved.

If Contractor does not achieve Substantial Completion by the date set forth in this Section, as may have been extended by Change Order, Contractor shall pay to District as liquidated damages the sum of $500.00 per day for each calendar day after the day set for Substantial Completion that Substantial Completion has not been achieved. See Section 5.32 below.

2.5 ASBESTOS

Asbestos containing materials (ACM) have not been found in the proposed work areas at either North or Northwest High Schools. It is the Contractor's responsibility to review and study the information that may relate to asbestos-bearing material with which the Contractor may come into contact. A document describing the general location and characteristics of this material is available in the building office or through the Asbestos Program Coordinator's office at 4041 North 72nd Street, Omaha, Nebraska 68134 for your review. During this Project, should any suspected material be found, Contractor should stop work in the area immediately and contact the Asbestos Program Coordinator's office at 531-299-0180.

2.6 ASBESTOS DAILY AWARENESS

Contractor shall be responsible for coordinating a central sign-in location at the facility where the Project is located for enforcement of the District’s requirements of the asbestos material awareness program. Each employee, subcontractor employee and other individuals under contract with the Contractor shall be advised of locations of any hazardous material at the facility. This sign-in certificate must be submitted weekly and prior to final closeout on the Project.

2.7 ASBESTOS REMOVAL, NOTIFICATION

All known and accessible asbestos-containing material has been identified for this Project area by the District’s Environmental Division. In the event Contractor encounters suspect asbestos-containing or other hazardous materials at the Project site, Contractor shall stop work immediately in the suspected contaminated area and contact the District’s Environmental Division at 531-299-0180.

2.8 EQUIPMENT AND INSTALLATION REQUIREMENTS

Contractor will be required to perform all Work and supply any and all materials, equipment and accessories described in the Contract Documents or that are necessary for completion of the Project. This includes supplying accessories such as, wiring and electrical connections and labeling as required by the Contract Documents, or reasonably inferable therefrom, so that the equipment being supplied by Contractor will be fully operational in this facility.

Work at the Project site shall start within forty-eight (48) hours of delivery of equipment, provided notice to proceed has previously been given by the District.

2.9 WARRANTIES

Contractor’s one (1) year warranty set forth in the General Terms and Conditions that are a part of the Contract Documents shall both run for a period of one (1) year from the date of Substantial Completion of both schools. Materials must be installed in a manner that does not void or limit any manufacturer’s warranty for such materials. Prior to final completion, Contractor will take any

corrective measures and work to assure that the full manufacturer's warranty will apply to this Project.

2.10 COLLUSIVE BIDDING

The bidder's submission of its bid response is the bidder's representation and guarantee to OPS that the prices quoted have been arrived at without collusion with any other eligible bidders and without an attempt to preclude OPS from obtaining the lowest possible competitive price, influencing the prices quoted by any other eligible bidder or discouraging other potential bidders from bidding.

2.11 MATERIALS AND EQUIPMENT TO BE FURNISHED

The specifications for any required materials and equipment are contained in the Project Drawings and Project Specifications for the Project prepared by BDH Engineering LLC (see Exhibits A and B), which are a part of the Bid Documents and will also be part of the Contract Documents for the Project.

3.0 PROJECT DRAWINGS AND PROJECT SPECIFICATIONS

The Project Drawings and Project Specifications have been prepared by BDH Engineering LLC and are a part of the Bid Documents and will become a part of the Contract Documents comprising the Contract between the Successful Contractor and OPS. Those Plans and Specifications are detailed below.

3.1 PROJECT SPECIFICATIONS

Project Specifications prepared by BDH Engineering, LLC, are contained in the Specification Divisions listed below and are included in the Bid Documents and attached as Exhibit A. These Project Specifications will also be included in the Contract Documents with the successful Contractor.

Project Specifications:

Cover	
Table of Content	
Plumbing General Provisions	22 00 00
Plumbing Submittals	22 00 10
Common Plumbing Materials and Requirements	22 05 00
Plumbing Insulation	22 07 00
Plumbing Piping	22 11 16
Plumbing Specialties	22 11 19
HVAC General Provisions	23 00 00
Mechanical Submittals	23 00 10
Variable Frequency Drives	23 09 15
Hydronic Piping and Specialties	23 21 13
Cooling Towers and Accessories	23 65 00
General Electrical	26 05 00
Wires and Cables	26 05 19
Raceways	26 05 33
Electrical Identification	26 05 53

3.2 PROJECT DRAWINGS

Project Drawings prepared by BDH Engineering, LLC, are contained in the plan sheets listed below and are included in the Bid Documents and attached as Exhibit B. These Project Drawings will also be included in the Contract Documents with the successful Contractor.

Drawing Sheets:

GENERAL	
Sheet Number	**Sheet Name**
COVER PAGE	
G0.0	COVER SHEET
Grand total: 1	

MECHANICAL	
Sheet Number	**Sheet Name**
MECHANICAL	
M0.0	MECHANICAL SYMBOLS LEGEND AND GENERAL NOTES
M0.1	MECHANICAL COM CHECK
M0.2	NORTH MECHANICAL KEY PLAN
M0.3	NORTHWEST MECHANICAL KEY PLAN
M0.4	NORTH MECHANICAL DEMOLITION PLAN
M0.5	NORTHWEST MECHANICAL DEMOLITION PLAN
M1.1	NORTH MECHANICAL PLAN
M1.2	NORTHWEST MECHANICAL PLAN
M4.1	MECHANICAL SECTIONS
M7.1	MECHANICAL DETAILS AND SCHEDULES
Grand total: 10	

ELECTRICAL	
Sheet Number	**Sheet Name**
ELECTRICAL	
E0.0	ELECTRICAL SYMBOLS LEGEND AND GENERAL NOTES
E0.1	ELECTRICAL COM CHECK
E0.2	NORTH ELECTRICAL KEY
E0.3	NORTHWEST ELECTRICAL KEY PLAN
E0.4	NORTH ELECTRICAL DEMOLITION PLAN
E0.5	NORTHWEST ELECTRICAL DEMOLITION PLAN
E1.1	NORTH ELECTRICAL PLAN
E1.2	NORTHWEST ELECTRICAL PLAN
E6.1	ELECTRCAL DIAGRAMS AND DETAILS
E7.1	ELECTRICAL SCHEDULES
Grand total: 10	

4.0 BID SUBMISSION INSTRUCTIONS AND REQUIREMENTS

4.1 GENERAL

To be considered, bids must be submitted in accordance with the bid instructions set forth in these Bid Documents. Failure to comply with the requirements of these bid instructions may result in the rejection of the bidder's bid proposal.

The term "Bid Documents" is defined in Section 1.0 of the Invitation to Bidders. The Bid Documents are incomplete if they do not contain all of the Bid Documents identified in that Section. Bids must be prepared on the unaltered bid form included in the Bid Documents with all required information provided and submitted in a sealed opaque envelope or container with the bid name, bid number and the date and time of the deadline for submitting bids noted on the exterior of the envelope or

container. DO NOT SUBMIT BIDS ON ANY OTHER FORM. Bids must also include the original bid bond and all attachments required by the Bid Documents. E-mail, facsimile or telephone bids will not be accepted. Any incomplete bid or bid not complying with the Bid Documents may be rejected by the District.

Bids are due at 2:00 PM Central time on the due date specified in the Cover Page at the Teacher Administrative Center, 3215 Cuming Street, Omaha, Nebraska 68131. Hand-delivered bids shall be brought to the Security Desk, East Entrance, Ground Floor. Any bid received after the deadline for submission of bids will not be considered and will be rejected and returned to the bidder unopened. The risk of delivery rests solely on the bidder. The time stamp on the District's timeclock in the District Operational Services' offices will be the official clock utilized to determine the time for the close of the time for submission of bids.

4.2 DISTRICT'S RIGHT

The District reserves the right to accept or reject any or all bids or any part thereof and to waive any and all technicalities and irregularities and award the Contract based on its determination of the best interests of the District.

4.3 PLANS AND SPECIFICATIONS

Bona fide bidders may inspect and obtain copies of the Plans and Specifications for the Project, prepared by the District and BDH Engineering, LLC, and identified in Exhibit A and Exhibit B of the Bid Documents, at any of the locations specified in the Bid Advertisement. Plans and Specifications are also available for download on the OPS Purchasing Department website.

4.4 MANDATORY PRE-BID MEETING

OPS will conduct a mandatory pre-bid meeting for interested bidders at North High Schools, 4410 N 36th St., Omaha, Ne 68111 on July 25, 2025, at 9 AM CST & Northwest High Schools, 8204 Crown Point Ave., Omaha, Ne 68134. on July 25, 2025, at 10 AM CST. Interested bidders must attend site visit for both schools. All attendees are required to sign-in at that time, and only those who attend the pre-bid meeting will be allowed to submit a bid. Proposals received from bidders not attending the pre-bid meeting will be returned unopened. Questions may be asked at the pre-bid meeting. However, such questions and the answers given will not be transcribed or transmitted to the other potential bidders.

4.5 BID QUESTIONS

Any questions or requests for interpretation of these Bid Documents must be submitted in writing by e-mail to the question submission box at the email address included on the Cover Page of the Bid Documents, by 2:00 p.m. CT on or before the deadline for submission of questions. **The subject line of the email must include at a minimum the Bid Name and Bid Number of the Project.** Both the question submission email box address and the deadline are listed on the Cover Page. Answers to questions will be posted on the OPS Purchasing website, the plan house websites in which the District has been requested plans be made available, and provided to all attendees who signed in at the Project pre-bid meeting, without indicating which Bidder submitted the question. The communications requirements have been established by the District to ensure a fair and equitable process for all potential respondents. The email address listed on the Bid Cover Page for questions is the only authorized location and representative of the District who can respond to questions regarding this bid. Questions submitted in any other form, including by hard copy, facsimile and telephone, and questions submitted to an email address other than the one indicated in these Bid Documents will NOT be answered. Any attempt to communicate with or contact any Board Member, employee, or consultant of the District of in any manner having to do with any aspect of this bid may result in the disqualification of the Firm as a potential supplier.

4.6 BID SECURITY

An original certified check or cashier's check payable to the Board of Education or satisfactory original Bid Bond executed by the bidder and acceptable sureties in an amount equal to five percent (5%) of the amount of the bid shall be submitted with each bid (the certified or cashier's check and the bid bond may sometimes be collectively or individually referred to in these Bid Documents as the "Bid Security"). If an original cashier's or certified check or an original signed Bid Bond (not a photocopy) as required by this Section is not submitted the District with the bidder's bid submission in a sealed opaque envelope or container by the bid submission deadline, the bid will not be considered. To be valid, the Bid Bond submitted must have original signatures of both the bidder and the surety on the Bond, and if signed by an attorney-in-fact for the surety, a valid power of attorney from the surety must be attached to the Bid Bond. The Bid Security will be retained as liquidated damages in case the bidder awarded the Contract fails to furnish the required Performance, Labor and Material Payment Bond, insurance certificate, or sign the Contract within ten (10) days after presentation of the Contract to the successful bidder. If original Bid Security as required by this Section is not received by the District with bidder's bid proposal by the deadline for submission of bids, is submitted in any other manner, or is submitted to an address other than the one indicated in these Bid Documents, the bid by bidder failing to properly submit the Bid Security will NOT be considered, even if the bid was otherwise properly submitted. The bidder shall have all risk of failed or late delivery of the Bid Security.

4.7 BID PREPARATION

All bids must be completed and submitted on the unaltered OPS bid form that is a part of the Bid Documents. DO NOT SUBMIT BIDS ON ANY OTHER FORM. If a new bid form is issued by OPS by an Addendum to the Bid Documents, the new bid form must be used for bid submission, and using an earlier version of the bid form may result in the bid being rejected. Unless specifically allowed in the Bid Documents, only one bid form may be submitted by any bidder. All required blanks on the bid form must be completed and be initialed and dated where indicated and the final page of the bid form must be signed by an authorized representative of the bidder. All attachments and required information requested in the bid form must be furnished, together with the Bid Bond. Bids are to be submitted to the location specified in the Bid Documents by the time and date indicated in the Bid Documents. Bids are to be submitted in a sealed opaque envelope or container addressed as specified on the Invitation to Bid with the required notation on the exterior of the sealed envelope or container. The amount bid shall be the total cost to OPS for the successful bidder awarded the bid to provide and furnish all labor, materials, equipment, tools, expendable equipment and all utility and transportation services necessary to perform and complete in a workmanlike manner all of the Work required by the Bid Documents. Bids that attempt to change, modify or add additional terms and conditions to the Bid Documents by conditioning a bid response upon the acceptance by OPS of Contract terms attached to a bid response or referencing in a bid response certain Contract terms on a web site shall be considered non-complying bids by OPS and the bid may be rejected by OPS.

4.8 BID SUBMITTAL

To be considered, one (1) copy the bidder's bid proposal prepared in compliance with the requirements of the Bid Documents must be submitted to the District by the proposal deadline listed on the Cover Page. The amount bid shall be the total cost to OPS for the Work specified, inclusive of all the labor, materials, equipment, tools, supplies and services enumerated in the Bid Documents, together with all insurance costs, delivery costs, duties, surcharges, tariffs and brokerage costs and no additional amount will be paid by OPS to the successful bidder for the Work. No bidder will be allowed to offer more than one price. Bids that attempt to change, modify or add additional terms and conditions to the Bid Documents will be rejected by OPS. Bids must be signed by an authorized signatory for bidder and initialed and dated where indicated. Bids and Bid Security must be submitted in hard copy to the address specified in the Bid Documents by the time and date indicated in the Bid Documents. The time stamp on the Purchasing Department time

clock will be the official clock utilized to determine the time for the close of submissions. Bids may be submitted either in person or by mail or courier to the address shown on the cover page. All submitted bids must comply with the following requirements:

- Bidder must include the Bid Proposal with the completed Signature page.
- Bid Security equal to 5% of the bidder's bid amount as previously described in Section 4.6.
- The bid must be submitted in hard copy with the bid title and bid number written on the exterior of the envelope or container containing the bid.
- All required attachments must be submitted with the bid proposal.

4.9 BID ATTACHMENTS

Bidders shall include with their bid responses the following attachments: (i) summary of the manufacturer's warranty terms for the materials and equipment the bidder is proposing to furnish; and (ii) the specifications for the Contractor furnished materials and equipment specified in Plans and in the Specification Manual of the Bid Documents that the bidder is proposing to furnish.

4.10 BID SUBMISSION DEADLINE

Bids are due by 2:00 p.m. Central time on the due date specified one the Cover Page and in the Bid Documents. Bids received after 2:00 p.m. Central time on the due date are considered late and will be returned unopened. OPS is not responsible for ANY late bids due to failure or delay in mail delivery. The bid must be received by the time and date indicated on the bid document. The risk of delivery rests solely on the bidder. Late bids will not be accepted. The time stamp maintained by District Operational Services shall be the official clock for determining when the time for submission of bids has closed.

4.11 WITHDRAWALS AND RESUBMISSIONS

Withdrawal of a bid may be made by a bidder any time prior to 2:00 p.m. Central time on the bid due date. A withdrawal may only be done by the bidder's written notification delivered to the same address where the bid was originally submitted, with the following notation on the exterior of the envelope containing the withdrawal: "Withdrawal of Bid" including the Bid number and the Bid title. The withdrawal notification must be received by the OPS Purchasing Division prior to the date and time of the bid submission deadline. An attempted withdrawal in any other form, including email, facsimile, telephone or oral withdrawal request will not be honored. An addendum or bid modification in lieu of a withdrawal is NOT acceptable and will be rejected. If properly withdrawn, a bid may be resubmitted in accordance with the Bid Documents so long as it is re-submitted prior to the deadline for submission of bids. All bids submitted and not withdrawn as specified in the Bid Documents shall remain open and be subject to acceptance for ninety (90) days after the bid due date and may not be withdrawn prior to the expiration of such 90-day period.

4.12 OPENING OF BIDS OR PROPOSALS

Bids will be opened and read aloud in public at the Omaha Public Schools Teacher Administrative Center, District Operational Services, 3215 Cuming St, Omaha, Nebraska 68131, immediately following the bid submission deadline stated on the Bid Document Cover Page. Those submitting bids can attend in person or remotely join the opening by accessing Microsoft Teams meeting at 1 402-509-3892 within the United States Phone Conference ID is listed on the Bid Cover Page. If attending in person, please arrive at the security desk at least 10 minutes prior to the 2:00 PM CT deadline.

4.13 BID TABULATIONS

Notes may be taken at the public reading of the bids at the specified time and date of the opening, or a personal inspection may be made of the bids after award has been made and documents are placed in central files in the Purchasing Division offices. In lieu of a visit, copies of the bid tabulations are available. The cost for a bid tabulation copy is $5.00 for any tabulation up to 20 pages in length. There is an additional charge of $.25 for each page in excess of 20 pages. Make checks payable to Douglas County School District 0001. Bidders may include a request for a bid tabulation copy with its bid response or may contact the OPS buyer to make a request. The buyer will notify the bidder regarding the cost of the bid tabulation once it is known.

4.14 BIDDER REPRESENTATION

In submitting a proposal, the Contractor represents that it has read the Bid Documents, that its bid is submitted in accordance therewith, that the bidder is familiar with the local conditions that may affect the bid and the performance of the Work by the successful bidder and that the bidder has all required governmental licenses to perform the type of Work required.

4.15 COLLUSIVE BIDDING

The bidder's submission of its bid response is the bidder's representation and guarantee to OPS that the prices quoted have been arrived at without collusion with any other eligible bidders and without an attempt to preclude OPS from obtaining the lowest possible competitive price, influencing the prices quoted by any other eligible bidder or discouraging other potential bidders from bidding.

4.16 POST-BID EVALUATIONS

Prior to recommendation to the Board of Education for the bid award, District will review the apparent low bidder's qualifications and credible experience in similar projects to assure that the bidder meets the experience required by the District in the Contract Specifications that are a part of the Bid Documents. As part of that evaluation, the District reserves the right to ask any bidder to provide references of companies that contracted with Contractor for similar projects, including the following information: Company Name(s), Contact Name, Phone Number, and Email Address.

4.17 BID AWARD

OPS reserves the right to reject any or all bids or any part thereof and to waive any and all technicalities and irregularities. This is an all or nothing bid, and the bid will only be awarded to one bidder. The OPS Board of Education must approve all bid awards and contracts of $50,000.00 or more. Except due to a holiday or an extenuating circumstance, the Board generally meets the first and third Monday of each month for approval of bids and purchases. Approval or award of a bid by OPS or its Board of Education does NOT constitute a contract between OPS and the bidder and no contract shall be deemed created, nor shall OPS be deemed obligated in any manner to bidder, until such time as the bidder furnishes the required Performance, Labor and Material Payment Bond, insurance certificate and an Agreement is signed by Contractor and OPS, or a Purchase Order is issued by OPS if no separate Contract is required. OPS will either sign an Agreement with or issue an official Purchase Order to the successful bidder which, together with the other Contract Documents incorporated therein, will constitute the Contract with OPS for the construction of the Project as specified in the Agreement or Purchase Order and will incorporate by reference into the Agreement or Purchase Order the Contract Documents (defined in the General Terms and Conditions, in Section 5.1 below). If an Agreement is to be executed, OPS will submit to the successful bidder after the bid award the Agreement form that will be utilized by the parties.

5.0 GENERAL TERMS AND CONDITIONS

5.1 GENERAL

The term “Contract Documents”, as used herein, means those documents that together form the Contract or Agreement between OPS and that consist of the following: the Agreement between OPS and the Contractor, all of the Bid Documents, including the Bid Invitation (Section 1.0), the Contract Specifications (Sections 2.0 to 2.11, inclusive), the Project Drawings and Project Specifications (Sections 3.0 to 3.2, inclusive), the Bid Submission Instructions and Requirements (Sections 4.0 to 4.17), the General Terms and Conditions (Sections 5.0 to 5.38, inclusive), the Bid Form and Signature Page, the form of the Performance, Labor, and Material Bond, Exhibits A and B, any Addenda issued by OPS, Contractor’s completed Bid Form including all attachments, and any subsequent modifications. The Contract Documents are incorporated by reference into the Agreement between OPS and Contractor and are a part of that Agreement and the Agreement, together with the other Contract Documents, constitutes the Contract between OPS and the Contractor. In the event of any conflict between the Contractor’s completed Bid Form and the other Contract Documents, the other Contract Documents shall control. The term “Contractor” as used herein, means the successful bidder that contracts with the District to furnish the Work being bid.

All work to be performed by Contractor shall be performed in a good and workmanlike manner and in conformance with the requirements of the Contract Documents.

The Contract Specifications in Sections 2.0 and the Project Drawings (Exhibit B) and Project Specifications (Exhibit A), prepared by BDH Engineering, LLC, in Section 3.0 are all incorporated into the Contract Documents provide the minimum requirements for materials, workmanship, construction, and finish. In general, all equipment to be furnished must be of good quality, new, unused, in good condition and undamaged and shall be constructed and installed as specified and of types of equipment and material as specified. Materials of equal or better quality by another manufacturer may be acceptable but only if submitted to the District in advance as a permitted alternate and approved by the District.

5.2 CONTRACTOR'S RESPONSIBILITY

Prior to commencing work, Contractor shall furnish to the District the bond and insurance certificates required by the Contract Documents. It shall be the responsibility of the Contractor to review and understand the Project Drawings and Project Specifications, to check the Project Drawings and Project Specifications carefully to ensure accurate fit of its particular items of equipment, and to field verify all on-job dimensions.

Contractor and District personnel will also meet for a pre-construction meeting and survey. The survey shall document the existing condition of interior finishes and existing spaces, sidewalks, driveways, doorways, windows, etc. adjacent to areas of Work. It shall also identify acceptable dumpster locations, construction parking, and Contractor-furnished watering stations and locations for temporary sanitary facilities for use by construction personnel.

Projects involving asbestos containing materials require Contractor to meet with the District’s Environmental Division at (531-299-0180) prior to starting work to ensure compliance with State of Nebraska Asbestos Control Program Regulations.

Contractor shall have all assigned workers of Contractor and any subcontractors be approved through OneSource and provide documentation of such to the District. All assigned Contractor and subcontractor employees shall wear proper identification badges as provided by OneSource.

Contractor shall protect all existing construction. Repair of any damage caused due to work under the Contract Documents is the responsibility of the Contractor and shall be promptly completed

as such damages arise. Similarly, Contractor shall repair any damage to the property of the District caused by Contractor or any subcontractor of Contractor.

Contractor and each subcontractor shall always enforce strict discipline and good order among employees and shall not employ on the work site any unfit person or anyone not skilled in the work assigned. Clothing shall not depict profane or vulgar images, words, or phrases unsuitable for students or staff. The District strictly prohibits the illegal use of drugs, alcohol consumption, and the possession of permitted and/or non-permitted firearms within the boundaries of District property.

If portions of the Work are to be performed within an OPS building or on OPS grounds while school is in session, Contractor shall take reasonable measures in conducting the Work during school hours to avoid unnecessary noise or disturbance. Offensive behavior and the use of loud, vulgar, or profane language is prohibited anywhere on OPS property and Contractor will be required to exclude offenders from the Work site. Contractor shall take all reasonable measures necessary to avoid any unauthorized contact between employees of Contractor or any Subcontractor and any students of OPS at the Work site.

Contractor will provide at its expense temporary sanitary facilities for use by construction personnel. District restrooms shall not be used by construction personnel.

5.3 CHANGES IN THE WORK

No change in the work required shall be made unless pursuant to a written change order that is approved by the District. No claim for an increase in the amount to be paid to Contractor or any extension of time to complete the Work shall be valid unless allowed by such approved change order.

5.4 LABOR PRACTICES

It shall be the Contractor's responsibility to prevent any labor disputes due to Contractor’s actions at the job site. In this regard, Contractor shall adhere to the following minimal guidelines to avoid labor disputes.

5.4.1 Become familiar with labor practices in existence at the job site as established by the existing contractors, and ensure that these practices are in place and enforced at all times during the performance of the work specified in these General Conditions.

5.4.2 Use experienced, established laborers and contractors for any work pertinent to the transportation, loading, unloading, distribution, uncrating and installation of all equipment, accessories and materials necessary for the performance of the work specified in these General Conditions.

5.5 NON-DISCRIMINATION

OPS does not discriminate on the basis of race, color, national origin, religion, sex (including pregnancy), marital status, sexual orientation, disability, age, genetic information, gender identity, gender expression, citizenship status, veteran status, political affiliation or economic status in its programs, activities and employment and provides equal access to the Boy Scouts and other designated youth groups. The following individual has been designated to accept allegations regarding non-discrimination policies: Superintendent of Schools, 3215 Cuming Street, Omaha, NE 68131 (531-299-9822). The following persons have been designated to handle inquiries regarding the non-discrimination policies: Director of Equity and Diversity (equityanddiversity@ops.org), 3215 Cuming St, Omaha, NE 68131 (531-299-0307).

5.6 USE OF TOBACCO PRODUCTS

There shall be no smoking or use of any tobacco or vaping products on/or within the property limits of District property. This regulation shall be enforced by the Contractor.

5.7 WORKER VERIFICATION

The Contractor contracting with the District shall be required to register with and utilize an electronic verification system or program, whether the work authorization program of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, 8 U.S.C. 1324a, now known as the “E-Verify Program” or an equivalent federal program designated by the Department of Homeland Security or other federal agency authorized to verify the work eligibility status of a newly hired employee pursuant to the Immigration Reform and Control Act of 1986. The Contractor shall require all subcontractors performing work under the Contract to also register and utilize such electronic verification system. The Contractor awarded the Contract and all of such Contractor’s subcontractor(s) shall use such electronic verification system to determine the work eligibility status of each new employee physically performing any services within the State of Nebraska under the Contract. Any person whom the electronic verification system determines is ineligible or not authorized to work in the United States shall not be permitted by the Contractor or any subcontractor to perform services in Nebraska under such Contract. The Contractor shall provide such reasonable documentation as District may request from time to time during the performance of the Contract and for five (5) years thereafter documenting compliance with the provisions of this Section. Failure to comply with the provisions of this Section shall constitute a default under the Contract with the District.

5.8 CIVIL RIGHTS

Contractor will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), as amended by the Equal Opportunity Act of 1972, all requirements imposed by or pursuant to the Regulations of the Department of Education (34 C.F.R. Part 100) issued pursuant to that title, the Pregnancy Discrimination Act of 1978, Federal Executive Order 11246, the Federal Rehabilitation Act of 1973,as amended, the Vietnam Era Veteran's Readjustment Assistance Act of 1974, Title IX of the Education amendments of 1972, the Age Act of 1972, the Americans With Disabilities Act of 1990,the Genetic Information Nondiscrimination Act of 2008, and the Nebraska Fair Employment Practice Act, Neb. Rev. Stat. §48-1122. Contractor agrees no person in the United States shall on the grounds of race, color or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which OPS receives federal financial assistance from the Department; and hereby gives assurance that the Institution will immediately take any measures necessary to effectuate this Agreement. Contractor further agrees to comply with all applicable requirements of state and local laws, ordinances, and regulations regarding nondiscrimination in employment. Contractor agrees not to discriminate in its employment practices and will render services under this Agreement without regard to race, color, national origin, religion, sex (including pregnancy), marital status, sexual orientation, disability, age, genetic information, gender identity, gender expression, citizenship status, veteran status, political affiliation or economic status. Any act of discrimination committed by Contractor or failure to comply with these statutory obligations when applicable shall be a default under the Contract Documents.

5.9 SUBCONTRACTING

If Contractor intends to utilize subcontractors for the performance of any services under the Contract, OPS shall have the right to review any subcontractors that the Contractor intends to use for this Contract. Any approved subcontractor shall meet all requirements of the Contract. Subcontractors selected by the Contractor will be the direct responsibility of such Contractor and not OPS. The responsibility for coordinating and managing the activities of a subcontractor lies with the Contractor and not OPS.

5.10 TERMINATION OF CONTRACT

In the event that the Contractor executes a Contract with OPS, or is issued a Purchase Order, and fails or refuses to perform such Contract or Purchase Order according to its terms, or in the event such Contractor otherwise defaults in the performance thereof, OPS may, in addition to all other rights that it may have at law or equity, terminate such Contract or Purchase Order, and may enter into a Contract with another vendor for the same product or service. Any additional costs incurred by OPS in obtaining such Products or services from a substitute contractor, shall be paid by Contractor to OPS, in addition to any other damages that OPS may have suffered due to such default. In the event of such termination, the Contractor shall not be entitled to any further payment under the Contract. Should the cost of completing the performance of the Contract, together with such damages and expenses incurred by OPS through the default of the Contractor, at that time exceed unpaid balance of the Contract price, the Contractor shall pay the difference to OPS upon demand by OPS, and in addition may recover any other damages as OPS is entitled to recover for Contractor's breach of Contract.

5.11 PUBLIC BENEFIT

For purposes of complying with Neb. Rev. Stat. §§ 4-108 through 4-114, if the Contractor is a sole proprietorship or a general partnership, the Contractor represents to OPS that the sole proprietor each general partner, as applicable, are citizens of the United States or that are qualified aliens under the federal Immigration and Nationality Act. Any qualified alien must provide to OPS that person's immigration status, alien number and a copy of their USCIS documentation upon request by the District.

5.12 GOVERNING LAW, JURISDICTION, AND FORUM SELECTION

The laws of the State of Nebraska shall govern the interpretation and performance of the Contractor Purchase Order between OPS and Contractor and of the Contract Documents without regard to its conflicts of laws principles. The Contractor who enters into the Contract with OPS or accept a Purchase Order from OPS shall irrevocably consent and submit to the personal jurisdiction of the state and federal courts of Nebraska. Any action brought to enforce or interpret any provision of the Contract Documents shall be brought in the state or federal courts located in Douglas County, Nebraska. The Contractor hereby acknowledges and agrees that the state and federal courts located in Douglas County, Nebraska, are proper and convenient forums in which to litigate any matter pertaining to the Bid Documents and the Contract Documents.

5.13 INDEMNITY

Contractor, on behalf of itself and its successors and assigns, hereby agrees to indemnify, defend, and hold harmless OPS and its Board members, officers, agents and employees, from any or all losses, damages, claims, liabilities, judgments, costs and expenses (including reasonable attorney's fees and expenses) arising out of or in connection with: (i) any act or omission of Contractor or Contractor's agents, contractors or employees; (ii)any default, breach, violation or non-performance of the Contract between the Contractor and OPS or (iii) any injury to persons or property or loss of life caused by Contractor or by Contractor's agents, contractors or employees, other than any such claims that are caused solely by the negligent or intentional act or omission of OPS, or its employees, agents, or contractors.

5.14 EMPLOYEE CLASSIFICATION

The Contractor agrees to abide by the provisions of Neb. Rev. Stat. 48-2901 to 48-2912, also known as the Employee Classification Act. In compliance with the Act, the Contractor shall to submit to District upon execution of the Contract and upon request an affidavit attesting that (1) each individual performing services for the Contractor is properly classified under the Employee Classification Act, (2) the Contractor has completed a Federal I-9 immigration form and has such

form on file for each employee performing services, (3) the Contractor has complied with Neb. Rev. Stat. § 4-114, (4) the Contractor has no reasonable basis to believe that any individual performing services for such Contractor is an undocumented worker, and (5) as of the time of this Contract, the Contractor is not barred from contracting with the state or any political subdivision pursuant to Section 48-2912. The Contractor acknowledges that a violation of the Act is grounds for rescission of this Contract by District. The Contractor further acknowledges that providing a false affidavit under Section 48-2911 to District may subject the Contractor to the penalties of perjury and upon a second or subsequent violation the Contractor shall be barred from contracting with the state or any political subdivision for a period of three years after the date of discovery of the falsehood. The Contractor shall require any and all subcontractors who perform work pursuant to the Contract to provide a similar affidavit, which shall be made available to the District upon request.

5.15 DISTRICT FURNISHED INFORMATION

Construction drawings of facility areas that are furnished by District are approximate and subject to on-site verification by the Contractor. Drawings are for clarification only and are not to scale.

5.16 SHOP DRAWINGS

If required by the Contract Documents, the Contractor shall furnish one (1) copy of shop drawings to the District for approval before fabrication. The District will not be responsible for or accept any equipment or material that is not constructed or manufactured in conformity with the approved shop drawings and the Plans and Specifications. The District will review shop drawings as soon as reasonably practical after they are submitted.

5.17 PERFORMANCE AND PAYMENT BOND

If the amount of the Contractor's Contract exceeds $10,000, the Contractor shall furnish within ten (10) days of the award of the Contract a Contractor's Performance, Labor and Material Payment Bond for the full and faithful completion of the work required by the Contract Documents in a sum equal to the full amount of the Contract price executed by a corporate bonding company licensed to transact such business in the State of Nebraska and acceptable to the District. To be valid, the Performance, Labor and Material Bond submitted must be signed by both the Contractor and the surety on the Bond, and if signed by an attorney-in-fact for the surety, a valid power of attorney from the surety must be attached to the Bond. The expense of such bond shall be borne by the Contractor. If at any time, in the judgement of the District, a surety on such a bond becomes unable to perform its commitments under such bond, or is otherwise unacceptable to the District, the Contractor shall furnish a substitute bond, with acceptable surety, within ten (10) calendar days after receipt of written notice to do so. There shall not be a lapse in any bond furnished by Contractor. The bond must be provided on the bond form attached to these Bid Documents.

5.18 FEDERAL TAXES

Where Federal statutes exempt OPS from the payment of excise or manufacturer's taxes on materials or equipment, bidders shall exclude the amount of any Federal excise or manufacturer's taxes from its bid. Contractor shall comply with all applicable federal tax laws.

5.19 NEBRASKA STATE AND CITY SALES AND USE TAX

The District is exempt from state and city sales and use taxes and no sales or use taxes shall be included in the bid or collected from OPS. The OPS tax-exempt number is 05-0597767. OPS will provide the Contractor with its tax-exempt form upon request. The District, a tax-exempt governmental unit, will appoint the Contractor to be its Purchasing Agent for the purpose of obtaining materials to be incorporated into the Work contemplated by these Bid Documents without the payment of sales or use taxes. Materials to be incorporated into the Project shall be purchased tax exempt from Nebraska sales and use taxes in the name of the District; and the bidder shall

exclude from its bid all State of Nebraska and Local Option Sales and Use Tax for materials. The bidder shall include State of Nebraska and Local Option Sales and Use Tax for materials which are used or consumed in performing the Work but which are not incorporated into the completed Project.

5.20 SOILS

If any soil is brought onto District property, it must be tested for environmental contaminates. Borrow soils used for the purposes other than for structural fill, such as finish grade, topsoil or surcharge, are required to be tested in the same manner for environmental contaminates. Contractor will inform District of the location of borrow soil no less than two weeks prior to its use on District property. Testing will include the collection of not less than three samples per borrow site. The District and/or their designated representative will perform soil sample collection.

Lead content of soil will be determined by analysis using either flame or furnace atomic absorption spectroscopy. Laboratories performing analysis for lead in soil will be certified by the National Lead Laboratories Accreditation Program (NLLAP) by mandatory participation in the Environmental Lead Proficiency Analytical Testing (ELPAT) program. Lead content will be reported as parts per million (ppm). Should any of the soil samples report a lead concentration greater than 200 ppm, the soil will not be allowed for use on District properties.

5.21 ASBESTOS, PCBs, OR HAZARDOUS WASTE

All known and accessible asbestos-containing material, polychlorinated biphenyls (PCBs) and hazardous waste has been or will be removed from the Project area by the District's Environmental Division. In the event Contractor encounters suspect asbestos-containing, PCB contaminated or other hazardous materials at the Project site, Contractor shall stop work immediately in the suspected contaminated area and contact the District's Environmental Division at 531-299-0180.

No asbestos containing products shall be used or installed in any District facility.

5.22 WORKER'S COMPENSATION INSURANCE

Each Contractor shall maintain at its own expense until completion of this Project and acceptance thereof by the District, Workers' Compensation Insurance coverage, covering the obligations of the Contractor in accordance with the provisions of the laws of the State of Nebraska. In case any Work is subcontracted, the Contractor shall require subcontractors similarly to provide such insurance covering the subcontractor's obligations to its employees. Each Contractor shall furnish the District with a certificate on or before the date the Agreement is signed, that such Contractor is covered by Worker's Compensation insurance for protection of their employees as required by law.

5.23 INSURANCE

The Contractor shall maintain such insurance as will protect themselves, any subcontractor, and the District, from claims arising from property damage liability, and from claims for damages because of bodily injury, including death, which may arise from and during the operations under and during the life of this Contract, whether such operations be by the Contractor or by any subcontractor or anyone directly or indirectly employed by either of them. This insurance shall be written in accordance with the limits of liability specified in the Contract Documents as outlined as follows and shall be written on an occurrence basis only. This insurance shall be written in accordance with the limits of liability specified in the following paragraphs. District shall be an additional insured on all insurance policies provided by Contractor. Contractor must at all times maintain the following insurance coverages:

Employer's Liability
$500,000 per accident

$500,000 disease, policy limit
$500,000 disease, each employee

Commercial General Liability
Bodily injury and property damage liability
$1,000,000 per occurrence
$2,000,000 general aggregate
$2,000,000 completed operations aggregate
$1,000,000 personal and advertising injury

General Liability Coverage must include the following:

(1) General Aggregate to apply on a per project basis.
(2) District shall be named as Additional Insured on a primary and non-contributory basis including completed operations.
(3) Contractor agrees to waive its rights of recovery against District. Waiver of Subrogation in favor of (District) shall be added to the policy.
(4) Contractual liability coverage shall be on a broad form basis and shall not be amended by any limiting provisions or endorsements.
(5) Products and completed operations shall be maintained for duration of work and shall be further maintained for a minimum period of two (2) years after final acceptance and payment.

Automobile liability coverage insuring both bodily injury and property damage with limits of liability per occurrence of at least $1,000,000 combined single limit. This insurance shall cover owned, non-owned and hired vehicles. Automobile liability insurance must also include insurance covering liability for transportation of asbestos containing materials.

Umbrella/Excess policy with limits of at least $2,000,000. Policy shall provide liability coverage in excess of the specified Workers Compensation/Employers Liability, Commercial General Liability and Auto Liability. Waiver of Subrogation in favor of the District shall be added to the policy. Policy limits shall apply on a per project basis.

All insurance required must be written by a company or companies licensed to transact such business either on an admitted or non-admitted basis in the State of Nebraska which are acceptable to the District. District shall be named as an additional insured on all such policies on a primary and non-contributory basis. All required policies of insurance and the certificates must provide for at least thirty (30) days written notice to District of any change in or cancellation of or termination of the coverage or coverages. All liability insurance to be furnished by Contractor shall provide "occurrence" coverage for any liability arising out of the Contract. Contractor shall maintain such liability insurance, including products and completed operations coverage, for a period of two (2) years after final acceptance of the work and shall provide District with certificates evidencing such coverage.

All projects where price quotes were solicited by bid or proposal must submit an individual insurance certificate noting all required coverages in place for that particular project prior to commencing any work on the project. Contractors or vendors who respond to small projects that are initiated by verbal request such as emergencies may submit an insurance certificate for general coverage in the amounts listed in this Section in force for a period of one-year.

5.24 BUILDERS' RISK/INSTALLATION FLOATER INSURANCE

Contractor will purchase and maintain Builder's Risk/Installation Floater Insurance equal to the amount of the Contract covering the entire Work at the Project site including all materials and equipment destined to become a part of the Work only if the Contractor is involved with construction activities related to the structural integrity of the building or any mechanical system of the

building. The District and subcontractors will be an additional insured under this policy. The Contractor will be responsible for the deductible portion of any covered loss due to loss caused by or contributed by the negligent act of the Contractor or subcontractor. This deductible shall not exceed $10,000. There will be a waiver of subrogation in favor of the District on all Builders' Risk/Installation Floater coverage. The District shall be named as an additional named insured on any Builders' Risk/ Installation Floater policy and will be named as an additional insured and loss payee on any installation floater policy.

Minimum limits of at least:
($TBD) Jobsite
($TDB) Off-site at a Temporary Location
($TBD) In Transit
Riggers Limit: ($TBD)

Contractor agrees to waive all rights of recovery against District and its agents, officers, directors and employees for any loss insured under such policy. Contractor's insurer shall endorse the policy to waive subrogation against the District and its agents, officers, directors and employees.

5.25 RIGGERS COVERAGE (if applicable)

If the Contractor will be using a crane or other equipment to rig or lift equipment or materials as part of this Project, the Contractor will maintain Riggers Coverage equal to the most expensive item rigged and lifted as part of the installation.

5.26 PAYMENT

Applications for payment may be submitted up to twice monthly. All such applications must be approved by the District's Board of Education at a regular meeting, usually held the first and third Monday of the month. Contractor should allow at least fourteen (14) business days prior to a Board meeting when submitting payment applications. Contractor shall submit applications for progress payments via email to the Project Manager (PM) and the Schoolhouse Planning Accounts Payable inbox at (planning.ap@ops.org). Invoices must be approved and processed 10 workdays prior to the next Board date where approval is requested for payment. Payments are generally issued the Tuesday following the Board meetings on the first and third Mondays of a month, except in those instances when the normal twice-monthly Monday Board of Education meeting is delayed, due to a holiday or other extenuating circumstance.

Such application for payment shall be accompanied by such other documents as are required by the Contract Documents or that may be reasonably required by the District. Such application for payment shall be reasonably detailed and shall include the value of any Work performed and materials incorporated into the Work, based on the Contractor's approved schedule of values, less any applicable retainage and less the aggregate of all previous payments. Retainage in the amount of 10% of the amount of each application for payment shall be retained from each payment until the work is 50% completed at which time retainage shall be reduced to 5% of each subsequent application for payment. District may reinstate 10% retainage at any time as permitted by law. Based on the PM's observations and an evaluation of the Contractor's applications for payment as submitted to the PM, the PM will determine the amounts owing to the Contractor and will forward the Contractor's Certificates for Payment to District for review and action in such amounts and with such recommendations as PM deems appropriate. Final approval of any application for payment shall be made by the District. At Substantial Completion of the work, retainage will be paid to Contractor, less 125% of the amount estimated by District to complete any incomplete work and the amount of unsettled claims against Contractor. Final payment of all remaining unpaid amounts will be paid as provided in Section 5.27 (Final Payment and Closeout) hereof.

The Contractor shall maintain books, records, and documents in accordance with generally accepted accounting principles and procedures and which sufficiently and properly document and

calculate all charges billed to OPS for a period of at least four (4) years following the date of final payment or completion of any required audit, whichever is later. Records to be maintained include both financial records and service records. The Contractor shall permit the Auditor of the OPS Board of Education or any authorized representative of OPS, and where Federal funds are involved, the Comptroller General of the United States, or any other authorized representative of Federal or State government, to access and examine, audit, excerpt and transcribe any directly pertinent books, documents, papers, electronically or optically stored and created records or other records of the Contractor relating to orders, invoices, or payments or any other documentation or materials pertaining to the Contract, wherever such records may be located during normal business hours. The Contractor shall not impose a charge for audit or examination of the Contractor's books and records. If an audit discloses incorrect billings or improprieties, OPS reserves the right to charge the Contractor for the cost of the audit and appropriate reimbursement. Evidence of criminal conduct will be turned over to the proper authorities.

5.27 FINAL PAYMENT AND PROJECT CLOSEOUT

Final payment shall not become due until the Contractor has provided the following documents to the District:

5.27.1 A satisfactorily completed punch list of deficiencies required to satisfy warranty requirements or been judged incomplete by District personnel.

5.327.2 A complete unconditional waiver and release of all lien and bond claims and rights arising out of this Contract, including Contractor and all subcontractors and all principal material suppliers or receipts showing payment in full in lieu thereof.

5.27.3 An affidavit of Contractor stating that the releases of liens payment receipts provided to the District by Contractor for labor and/or material supplied to the Project include all subcontractors and principal suppliers.

5.27.4 Contractor may, if any subcontractor refuses to furnish a lien waiver, furnish a bond satisfactory to the District, to protect District from against any bond claims or liens from such subcontractor.

5.27.5 Original Consent of Surety to Final Payment.

5.27.6 Material Safety Data Sheets (MSDS) for all materials used in the completion of work.

5.27.7 Original Contractor's one (1) year Labor & Workmanship Warranty as provided in section 5.29.

5.27.8 Original Manufacturer's Material & Equipment Warranty with Contractor's assignment to the District.

If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the District all monies the latter may be compelled to pay in discharging such a lien, including all costs, interest and reasonable attorney's fee.

5.28 COMPLIANCE WITH LAW

The Contractor, in performance of the Work called for in the Contract Documents, will comply with all applicable governmental laws, ordinances, regulations, and codes. Contractor shall have the necessary rights, licenses and approvals required to provide the specified Products and services.

The laws of the State of Nebraska shall govern the interpretation and performance of the Contract between OPS and Contractor and of the Contract Documents without regard to its conflicts of laws principles. The Contractor who enters into the Contract with the District shall irrevocably consent and submit to the personal jurisdiction of the state and federal courts of Nebraska. Any action brought to enforce or interpret any provision of the Contract Documents shall be brought in the state or federal courts located in Douglas County, Nebraska. The Contractor hereby acknowledges and agrees that the state and federal courts located in Douglas County, Nebraska, are proper and convenient forums in which to litigate any matter pertaining to the Bid Documents or the Contract.

5.29 DEFECTIVE WORK AND WARRANTIES

The District, or its designated representative, prior to final completion and acceptance of the Work, shall have the right to reject any work, materials, or equipment that are defective, which Contractor shall promptly correct. For a period of one (1) year from the date of Substantial Completion of the Contractor's work, the Contractor will, upon demand by the District, promptly make all repairs and replacements to the work at Contractor's cost due to any defects in the equipment, material or workmanship furnished and performed under the Contract Documents. This warranty is in addition to all other warranties provided in the Plans and Specifications. In addition to the Labor and Material Warranty, all manufacturers' warranties provided by the equipment or material manufacturers must be assigned to the District.

5.30 PERMITS

The successful Contractor shall be responsible for securing the necessary permits required to perform the work. Fees are not assessed against the District for permits issued by the Permits and Inspections Division, City of Omaha; however, fees for electrical work are assessed by the State of Nebraska and shall be paid by Contractor.

5.31 THE DISTRICT'S RIGHT TO DO WORK

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the District, after seven (7) calendar days' written notice to the Contractor may, without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

5.32 PERFORMANCE OF WORK AND LIQUIDATED DAMAGES

It is hereby understood and mutually agreed, by and between the Contractor and the District, that the date of beginning, rate of progress, and the time for completion of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the Specifications.

The Contractor agrees that the Project shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed by and between the Contractor and the District, that the time for the completion of the Project described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial prevailing in this locality.

IF THE CONTRACTOR SHALL NEGLECT, FAIL OR REFUSE TO COMPLETE THE PROJECT WITHIN THE TIME SPECIFIED IN THE CONTRACT DOCUMENTS, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the District the amount specified in the Contract, not as a penalty, but as liquidated damages for such breach of Contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for Substantial Completion of the Work.

The liquidated damages amount is fixed and agreed upon by and between the Contractor and the District because of the impracticability and difficulty of fixing and ascertaining the actual damages the District would in such event sustain, and said amount is agreed to be the amount of damages which the District would sustain and said amounts shall be retained from time to time by the District from current periodical estimates. It is further agreed that time is of the essence of each and every portion of this Contract and of the Plans and Specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever and where under the Contract an additional time is allowed for the completion of any Work, the new time limit fixed by such extension shall be of the essence of this Contract.

Contractor shall not be charged with liquidated damages for those days of delay that are solely due to the occurrence of any of the following that actually delay the performance of the Work:

(1) any material shortage caused by preference, priority or allocation order duly issued by the Government, or

(2) any unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, fires, floods, epidemics, quarantine, restrictions, strikes which preclude the Contractor from working on the site or from obtaining materials necessary to the progress of the work and material shortages due to freight or trade embargoes.

Provided that each case, the Contractor must, within seven (7) calendar days from the beginning of such delay from such cause, request an extension of time by change order, which must be approved by the District. The liquidated damages provision regarding delays does not in any way impact the District's right to recover its actual damages for defective performance of the contracted-for scope of Work.

5.33 DISTRICT'S RIGHT TO TERMINATE CONTRACT

The Contractor shall be in default and the Contract with Contractor may be terminated by the District should any one or more of the following conditions occur:

5.33.1 The Contractor should be adjudged as bankrupt.

5.33.2 The Contractor makes a general assignment for the benefit of creditors.

5.33.3 A receiver is appointed to take over the Contractor's affairs.

5.33.4 The Contractor fails to prosecute the Work with due diligence and carry the Work forward in accordance with the Project schedule and time limits set forth in the Contract.

5.33.5 The Contractor fails to promptly pay any subcontractor or suppliers without justification.

5.33.6 The Contractor fails to perform one or more of the provisions of the Contract.

In such cases, the District may serve written notice on the Contractor and the Surety on Contractor's performance bond stating its intention to exercise one or more of the remedies set forth in Section 5.34 and the grounds upon which the District bases its right to exercise such remedy.

5.34 DISTRICT REMEDIES FOR DEFAULT

In the event the District serves written notice referred to in Section 5.33 on Contractor, District may, without prejudice to any other right or remedy, exercise one or more of the following remedies at once.

5.34.1 The District may terminate the employment of the Contractor, effective immediately. Should the Contractor's Surety fail to commerce completion of the Contract within the ten (10) calendar days after notice of termination, the District may:

5.34.1.1 Take over the work, taking possession of and use all materials, tools, equipment and appliances on the premises, and

5.34.1.2 prosecute the work to completion by such means as it shall deem best.

In the event of such termination of employment, the Contractor shall not be entitled to any further payment under the Contract until the work is completed and accepted. If the unpaid balance of the Contract price, including compensation for any damages or expenses incurred by the District through the default of the Contractor at that time, exceeds the cost of completing the work, then such excess shall be paid to the Contractor upon completion and acceptance by District and satisfaction of any claims of District against Contractor. Should such damages or expenses incurred by the District through the default of the Contractor at that time exceed unpaid balances of the Contract price, the Contractor and its Surety shall pay the difference to the District.

5.34.2 The District may take control of the work and either:

5.34.2.1 Correct the deficiencies of the Contractor itself, or

5.34.2.2 Direct the activities of the Contractor and in doing so, employing such additional help as the District deems advisable.

In such event, the District shall be entitled to collect the cost thereof from the Contractor and its Surety, or deduct from any payment then or thereafter due the Contractor the cost incurred by the District to have such deficiencies corrected or expenses incurred through the default of the Contractor.

5.34.3 The District may require the Surety on the Contractor's bond to take control of the Work at once and see to it that all the deficiencies of the Contractor are corrected, with due diligence. As between the District and Contractor, the cost of correcting such deficiencies shall all be borne by the Surety.

5.34.4 If the Surety takes over the Project, either upon termination of employment of the Contractor or upon instructions from the District to do so, the provisions of the Contract Documents shall govern in respect to Work done by the Surety, the Surety being substituted for the Contractor as to such provisions including provisions as to payment for the Work and the provisions as to the right of the District to do the Work itself, or take control of the Work.

5.35 TERMINATION FOR CONVENIENCE

At any time during the term of the Contract, the District may terminate the Contract for its convenience and without cause by written notice to Contractor given at any time during the term if the Contract, which notice shall specify the effective date of termination. In the event that the District elects to terminate this Contract without cause, the District will remain obligated to take possession of and pay the Contract price for all Work that has been completed and accepted by the District at the time the notice of such termination is given. The parties shall be released of further obligation under the Contract except for those obligations that are to survive termination and the obligations of the parties.

5.36 GOVERNING LAW, JURISDICTION, AND FORUM SELECTION

The laws of the State of Nebraska shall govern the interpretation and performance of the Contract or Purchase Order between OPS and Contractor and of the Contract Documents without regard to its conflicts of laws principles. The Contractor who enters into the Contract with OPS or accept a Purchase Order from OPS shall irrevocably consent and submit to the personal jurisdiction of the state and federal courts of Nebraska. Any action brought to enforce or interpret any provision of the Contract Documents shall be brought in the state or federal courts located in Douglas County, Nebraska. The Contractor hereby acknowledges and agrees that the state and federal courts located in Douglas County, Nebraska, are proper and convenient forums in which to litigate any matter pertaining to the Bid Documents and the Contract Documents.

5.37 ASSIGNMENT

Contractor awarded the Contract or issued the purchase order shall not assign the same in whole or in part to any other person or entity without the prior written consent of OPS, which shall not be unreasonably withheld. No interest of Contractor in the Contract shall be transferred by operation of law.

5.38 PUBLIC RECORDS

As a Nebraska political subdivision, OPS is subject to the requirements of the Nebraska public records laws (Neb. Rev. Stat. §§ 84-712 to 84-712.09), which allows members of the public to have access to any information or records, regardless of physical form, of or belonging to a Nebraska political subdivision, such as OPS. As defined by Nebraska law, examples of public records subject to disclosure during a bid procedure will include the Bid Documents, a bidder's bid and any other document submitted by a bidder to OPS, bidder questions and OPS responses, any contract between OPS and the successful bidder, any purchase order issued to the successful bidder by OPS, or any other public record in the possession of OPS regarding this bidding and contracting process, whether created before or after the Bid Documents were issued by OPS and whether created by OPS, the bidders or any other third party. These public records will be open to public inspection and copying unless exempted from disclosure in accordance with the OPS's interpretation and application of applicable law. Documents exempt from disclosure under the Nebraska public records laws are enumerated at Neb. Rev. Stat. §712.05. It shall be the sole responsibility of a bidder (a) to notify OPS, as soon as possible, of any requested redactions to any such information or records provided by the bidder to OPS that may otherwise be required to be open to public inspection and copying and (b) to indicate the legal basis for such requested redactions. In addition, bidder agrees to defend OPS in any legal challenge to such requested redactions at the bidder's own expense. The failure of a bidder to request redactions to any information or records released by OPS shall constitute a complete waiver of any and all claims for damages caused by any such release. Any attempt by a bidder to request a redaction or otherwise claim confidentiality as to any public record in the possession of OPS will be ineffective and not, by itself, binding upon OPS unless OPS has independently determined that the bidder's request that a document, or portion thereof, is entitled to be withheld from public inspection and copying or if OPS is ordered by a court of appropriate jurisdiction to allow public inspection and copying of the document.

BID FORM

BID NO. 26-004

OPS North and Northwest High School Cooling Tower Replacement Project

Proposal of _____, a [ ] corporation organized and existing under the laws of the State of _____; a [ ] limited liability company organized and existing under the laws of the State of _____; a [ ] partnership, organized and existing under the laws of the State of _____; or an [ ] individual (check the appropriate box).

TO: Omaha Public Schools
Purchasing Division
3215 Cuming St.
Omaha, NE 68131

The undersigned, having familiarized themselves with the work at the place where the Work is to be done and with the Plans and Specifications and other Contract Documents hereby proposes and agrees to perform everything required to be performed, and to provide and furnish all labor, materials, tools, expendable equipment and all utility and transportation services necessary to perform and complete in a workmanlike manner all of the Work required by the specifications for OPS North & Northwest High School Cooling Tower Replacement Project, all in strict accordance with the Plans, Specifications and other Contract Documents as prepared by Douglas County School District 0001 ("District") and BDH Engineering LLC for the consideration hereinafter set forth.

In submitting this bid the Bidder certifies to the District that the bidder is complying with, and will continue to comply with, all applicable Fair Labor Standards set forth in Chapter 73 of the Nebraska Revised Statutes.

The undersigned agrees that this bid cannot be withdrawn and can be accepted by the District for a period of ninety (90) days subsequent to the opening of bids without the consent of the Board of Education. The undersigned further acknowledges that the District reserves the right to accept or reject any or all bids and any part thereof and to waive any and all technicalities and irregularities.

The undersigned proposes to furnish all labor and materials (required to be furnished by the Contractor) and complete all Work as required by the Contract Documents for this Project for the following amount.

OPS North and Northwest High School Cooling Tower Replacement Project -- Lump Sum Base Bid:

_____Dollars ($_____)
(amount in words) (amount in numerals)

(Initial: _____)
(Date: _____)

In the event of a discrepancy between the amount shown in figures and the amount shown in writing on the previous pages, the written amount shall take precedence and will be used.

Attachments:
1. Bid Bond
2. Summary of the manufacturer's warranty terms
3. Specifications for the Contractor furnished materials and equipment

SIGNATURE PAGE
BID NO.: 26-004

The undersigned certifies that the information in the foregoing bid is submitted in accordance with the requirements of the Bid Documents and is true and correct to the best of the undersigned's knowledge and belief. The undersigned further represents to the District that the undersigned is duly authorized to sign this Signature Page on behalf of the referenced company

COMPANY NAME: _____

ADDRESS: _____

CITY/STATE/ZIP:_____

EMAIL ADDRESS: _____

PHONE:_____FAX #: _____

SIGNATURE: _____

Bids must be signed to be valid.

PRINTED NAME: _____

TITLE: _____

DATE: _____

Acknowledge Receipt of Bid Addendum:

Addenda No. _____ Dated: _____
Addenda No. _____ Dated: _____
Addenda No. _____ Dated: _____

PERFORMANCE, LABOR AND MATERIALS BOND

KNOW ALL MEN BY THESE PRESENTS That we _____as principal and _____ as Surety are held and firmly bound to the Board of Education of the Douglas County School District 0001, a political subdivision of the State of Nebraska, in the penal sum of $ _____ to be paid to said Board of Education of the Douglas County School District 0001 for which payment to be well and truly made, we bind ourselves and each of us, our and each of our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

Dated this_____day _____A.D., 20_____.

The condition of this obligation is that:

Whereas, by even date herewith the said principal has entered into a contract with the said Board of Education of the Douglas County School District 0001 to perform the labor and furnish the material for_____ _____a copy of which said contract is attached hereto and made a part hereof.

NOW THEREFORE, the conditions of this obligation are such that if the said principal shall duly perform and observe all the stipulations and agreements in said contract on his part to be performed and observed, then and in that event this obligation shall be void and of no effect, but otherwise shall be and remain in full force and effect. It is expressly agreed that any alterations which may be made therein by agreement between the said principal and the said Board of Education of the Douglas County School District 0001, in the terms of said contract, or the nature of the work to be done there under, or the giving of any extensions of time for performing the said contract, or of any of the stipulations therein contained, and on the part of said principal to be performed, or any other forbearance shall not in any way release the said Surety from this liability under the above written bond. It is further expressly agreed and understood that this Bond shall stand as Surety for the payment of all laborers and mechanics for labor that shall be performed and for the payment for material and equipment rental which is actually used or rented in performing said contract.

IN TESTIMONY WHEREOF, the said parties hereto have hereunto set their hands this _____day of _____ _____, 20____and said Surety has caused these presents to be sealed with its corporate seal and duly attested by the signature of its attorney in fact, and their authority is attached hereto and made a part hereof.

_____ _____

_____ _____

(Principal) (Surety)

In the presence of _____

EXHIBIT A

[PROJECT SPECIFICATIONS]

OMAHA PUBLIC SCHOOLS
NORTH AND NORTHWEST HIGH SCHOOL – COOLING TOWER REPLACEMENT
CONSTRUCTION DOCUMENTS

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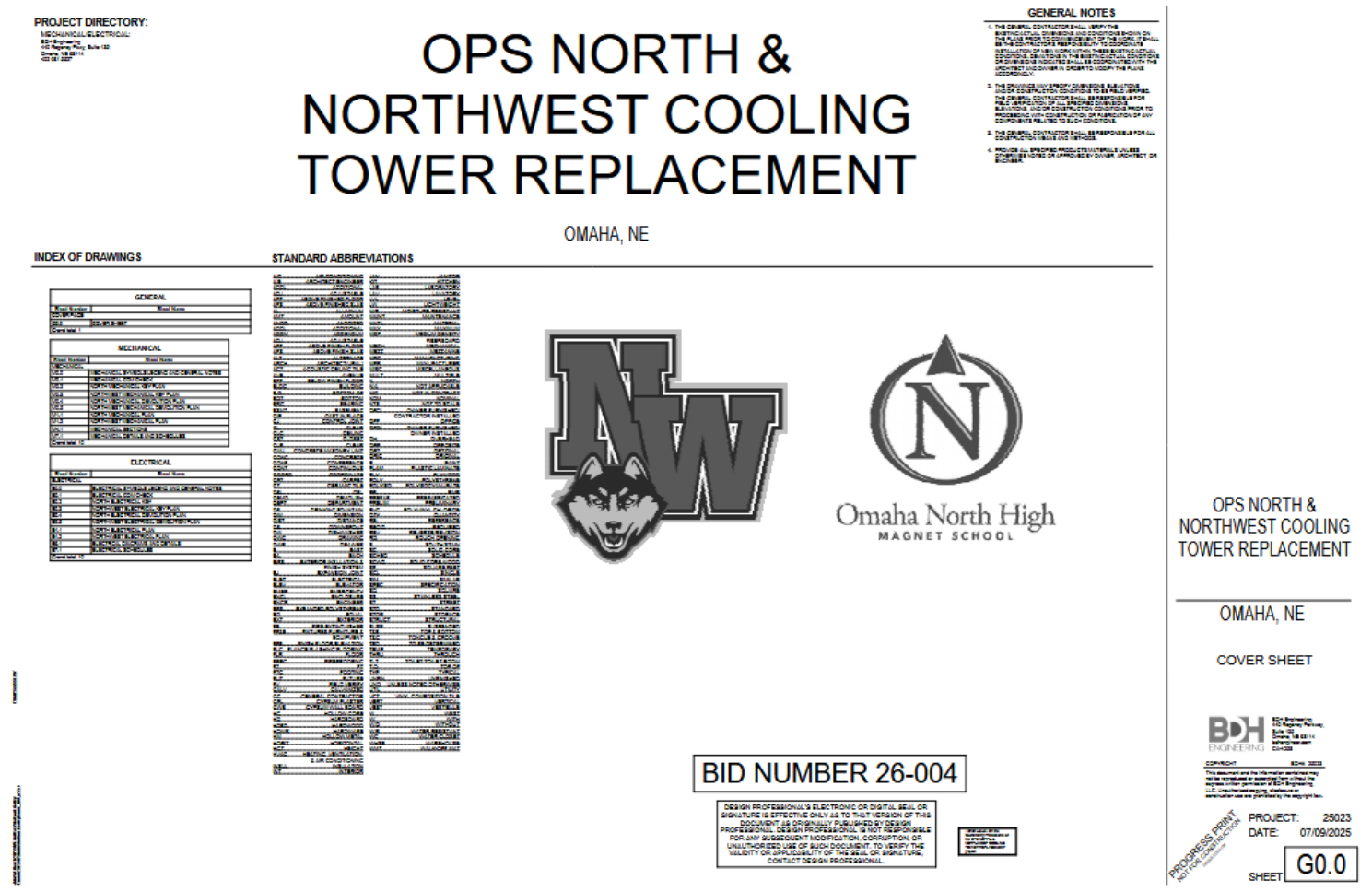
EXHIBIT B

[PROJECT DRAWINGS]



PROJECT MANUAL

CONSTRUCTION SET

DIVISIONS 22,23,26

OPS NORTH AND NORTHWEST HIGH SCHOOL

COOLING TOWER REPLACEMENT

OMAHA, NE

BID No: 26-004

Prepared By:

BDH Engineering, LLC
440 Regency Parkway Dr.
Omaha, NE 68144
402-981-5527

Owner:

Omaha Public Schools
District Operational Services
3215 Cuming St.
Omaha, NE 68131

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SECTION 22 0000
PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes general requirements for plumbing systems.

1.03 CONTRACT DOCUMENT COORDINATION

A. Contract Drawings are diagrammatic in showing certain physical relationships between architectural, structural, plumbing, mechanical and electrical work.
   1. Verification and coordination of these relationships is the responsibility of the Contractor.
   2. Verify all existing conditions before starting work.
   3. Floor plan drawings do not necessarily indicate all required offsets, fittings, valves, etc.
   4. Provide all necessary piping, fittings, valves, offsets, and other specialties required without additional cost to the Owner.

B. Should Contract Document requirements appear to make it impossible in providing a complete and operational system, or should discrepancies appear among Contract Documents, Contractor shall request clarification before proceeding with work.

1.04 QUALITY ASSURANCE

A. Comply with all State, and local codes and ordinances.

B. Obtain and pay for all required permits, fees and certificates of inspection of the work.

C. Install equipment and devices to provide required access for servicing and maintenance.

D. Comply with applicable portions of Local, City, and State Plumbing Code pertaining to plumbing materials construction and installation of products.

E. Fabricate and install potable water and natural gas systems in accordance with Local Utility Company requirements.

F. Do not interrupt plumbing services to occupied facilities without written permission from Owner and a minimum three (3) days' notice.

1.05 SUBMITTALS

A. General:
   1. See Division 01 Submittal Procedures.
   2. Shop Drawing Submittals shall include specially prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information.
   3. Shop Drawing Submittals may also include product data which includes standard printed information on materials, products and systems; not specially prepared for this project, but with the designation of selections from among available choices for this project clearly identified.

B. Submittal Requirements:
   1. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect/Engineer's review with another.
   2. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name, specification section and similar information to distinguish it from other submittals.

3. Provide General Contractor's and Subcontractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Contract Documents. Submittals which are received from sources other than through Contractor's office will be returned by Architect/Engineer "Without Action".
4. Items from each specification section shall be prepared as separate submittals, not grouped or bound with other items. Submittals shall clearly indicate the applicable specification section.

C. Alternate Equipment Submittal by Contractor:
1. Equipment of greater or larger dimensions, weight, capacity, or rated performance than that which is specified may be submitted provided all connecting mechanical and electrical services, including ductwork and piping connections, circuit breakers, electrical conduit and conductors, motors, equipment supports, building structure, and equipment spaces are modified as required by the proposed equipment. If performance ratings or efficiencies of the equipment are specified, the equipment must meet or exceed these design requirements as well as any specified commissioning requirements. **NO ADDITIONAL COST WILL BE APPROVED FOR ANY SUCH CHANGES RELATED TO THE ALTERNATE EQUIPMENT.**
2. Should proposed alternate equipment involve rearrangement of other designed equipment, a complete layout of the area involved shall be submitted by the Contractor along with the alternate equipment submittal, and shall be approved in writing by the Architect/Engineer prior to ordering, purchasing, delivery or installation of any such items of equipment.
3. **CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ADDITIONAL EXPENSE AND COORDINATION WITH OTHER TRADES RESULTING FROM THE SUBSTITUTION OF EQUIPMENT OTHER THAN THAT SPECIFIED IN THE CONTRACT DOCUMENTS.**

D. Submittal Review:
1. Review of submittal data is only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the plans and specifications.
2. Review of submittal data does not release the Contractor from further satisfactory equipment operating responsibilities. Equipment shall be approved for final acceptance when installation is completed and all equipment and systems have been operated, tested and adjusted in compliance with the contract documents.
3. Re-submittals: When revised for resubmission, clearly indicate all changes since previous submission. Only those items required to be resubmitted shall be included.

E. Operation and Maintenance (O&M) Manuals:
1. Prepare and submit three copies of operation and maintenance instructions for all Division 22 equipment and fixtures furnished.
   a. Provide individual 3-ring binders with a table of contents and tabbed sections for each specification section.
   b. Identify equipment and fixtures included in the manuals by the equipment or fixture mark used in the contract drawings.
   c. Include emergency instructions, spare parts listing, copies of warranties, wiring diagrams, shop drawings, product data, signed letters of certification of inspection and similar information.
   d. Provide documentation that training was performed for each item specified to include Owner training. Include name of Owner's representative(s) present, date and time of training.
   e. Provide a list of manufacturer's representatives for each item of equipment including company name, address and phone number.
   f. Provide documentation that Extra Materials were received by the Owner for each section requiring Extra Materials.

2. All information contained in equipment and fixture manufacturer's operation and maintenance manual shall be specific to equipment and fixtures provided. Contractor shall mark out or not include all unrelated information.
3. Electronic O&M Manuals: Provide electronic version of project O&M Manuals in pdf format in addition to hardcopy version of the manuals.

F. Contractor shall be responsible for all additional expense and coordination with other trades resulting from the substitution of equipment to that specified in the Contract Documents.

G. Review of shop drawings does not release the Contractor from further satisfactory operating responsibilities. Material and equipment shall be approved for final acceptance when construction is completed and all equipment and systems have been operated, tested, adjusted and balanced to the satisfaction of the Architect/Engineer. Should proposed approved alternate equipment involve rearrangement of designed equipment, a complete layout of the area involved shall be submitted by the Contractor, and shall be approved in writing before installation of any such items of equipment.

H. Required Submittals List:
1. Shop Drawings shall be submitted for the items listed in each section of the specifications. Submittals in addition to those listed may be required by the Architect/Engineer.

1.06 RECORD DRAWINGS

A. See Division 01 "Project Record Documents".

B. Provide a set of plumbing drawings marked-up with actual as-built conditions for Division 22 work. Record drawings shall include all addenda and change orders.

1.7 CLEANING AND PROTECTION

A. During the construction period the Plumbing Contractor shall clean and protect work in progress and adjoining work on a basis of perpetual maintenance.

1.8 FINAL COMPLETION

A. The Plumbing Contractor shall not call for a final completion check until Plumbing Systems have been installed, adjusted, tested and in full and complete satisfactory operation and the following certifications of inspection from equipment suppliers have been completed.

1.9 GUARANTEE

A. The one year guarantee period shall not start until the project is completed and the Contractor has received the Final Payment and Certificate of Completion.

B. Equipment and work shall be guaranteed, parts and labor, for one full year from the date of the Certificate of Completion. Repairs made during this period shall be fully guaranteed for an additional one year period from the date of repairs.

C. Plumbing Contractor has the responsibility to guarantee equipment and work and shall assume responsibility to repair any equipment at his cost that the manufacturer refuses to guarantee.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 PIPE HANGING AND SUPPORT

A. Piping systems shall be supported from building structural systems capable of supporting the applied load.

B. Piping shall not be supported from metal roof decking.

3.02 PAINTING AND FINISHING

A. Painting of exposed plumbing work is specified and performed under other divisions of these specifications, or as indicated on the drawings.

B. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish at the time of final inspection.

3.03 WORK IN EXISTING BUILDINGS

A. Work under this Contract includes additions and/or renovations to an existing building. It shall be the responsibility of each Bidder to inform himself of all conditions which affect the work contemplated by these Contract Documents. The submission of proposal by any Bidder will be construed as an admission by him that he has examined and is familiar with the premises and all conditions thereon and adjacent thereto, and has included in this proposal a proper and adequate amount to cover rearrangement of existing work for the proper installation and operation of the new and existing equipment as shown on the drawings or as required by these specifications.

B. Maintain existing plumbing services to occupied areas and operational facilities unless otherwise indicated or when otherwise authorized in writing by Owner and Architect.

C. The operation of existing equipment, fixtures and devices designated to remain shall be maintained. Provide temporary connections and devices as necessary to maintain the operation of the equipment designated to remain as required during construction.

3.04 REBATES

A. Contractor shall assist the Owner with filing of applicable forms to obtain rebates. This shall include but not be limited to determination of qualifying equipment, fixtures and materials and furnishing invoices for equipment, fixtures and materials as required to support the rebate application.

END OF SECTION

SECTION 22 0010

PLUMBING SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 GENERAL

A. Submittals shall include specially prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.

B. Submittals shall also include product data which includes standard printed information on materials, products and systems; not specially prepared for this project, but with the designation of selections from among available choices for this project clearly identified.

1.03 SUBMITTAL REQUIREMENTS

A. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect/Engineer's review with another.

B. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and providing space for Architect's/Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through Contractor's office will be returned by Architect/Engineer "Without Action".

C. Provide Contractor's certification on form, ready for execution, stating that information submitted complies with requirements of contract documents.

D. The Contractor shall be responsible for and bear any expense of alterations to the building or its appurtenances resulting from the substitution of equipment to that specified in the Contract Documents.

E. Review of submittals does not release the Contractor from further satisfactory operating responsibilities. Material and equipment shall be approved for final acceptance when construction is completed and all units and systems have been operated, tested, adjusted and balanced to the satisfaction of the Architect/Engineer. Should proposed approved alternate equipment involve rearrangement of designed equipment, a complete layout of the area involved shall be submitted by the Contractor, and shall be approved in writing before installation of any such items of equipment. Any additional expense involved shall be a Contractor-borne expense.

F. Electronic Submittals: All submittals for shop drawings, O & M Manuals and Record Drawings shall be in electronic PDF format. 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., North HS 22 05 00). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., North HS-22 05 00-A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and/or Construction Manager.

4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Architect, Engineer and Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.
   h. Category and type of submittal.
   i. Submittal purpose and description.
   j. Specification Section number and title.
   k. Specification paragraph number or drawing designation and generic name for each of multiple items.
   l. Drawing number and detail references, as appropriate.
   m. Location(s) where product is to be installed, as appropriate.
   n. Related physical samples submitted directly.
   o. Indication of full or partial submittal.
   p. Transmittal number, numbered consecutively.
   q. Submittal and transmittal distribution record.
   r. Other necessary identification.
   s. Remarks.

1.04 SUBMITTAL LIST

A. Submittals shall be submitted for, but not limited to, the items listed in each section of the specifications. Submittals, in addition to those listed, may be required by the Architect/Engineer. The following submittal register is a summary list of submittals required for the project.

SUBMITTAL REGISTER	
SECTION	ITEM
22 0000	O&M Manuals
22 0000	Record Drawings
22 0000	Certification of Inspection
22 0500	Plumbing Pipe and Fittings
22 0500	Plumbing Valves and Specialties
22 0500	Meters and Gauges
22 0500	Plumbing Support and Anchors
22 0500	Plumbing Identification
22 0500	Joint Sealants
22 0700	Plumbing Insulation Product Data & Installation Instructions
22 1116	Pipe and Fittings
22 1116	Plumbing Valves, Meters, Mixing Valves, Trap Primers, Interceptors

END OF SECTION

SECTION 22 0500
COMMON PLUMBING MATERIALS AND REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following common plumbing materials and requirements.
   1. Valves:
      a. Ball
      b. Check
   2. Valve Tags and Schedules.
   3. Supports and Anchors:
      a. Piping hangers and supports
      b. Saddles and shields
   4. Plumbing Identification.
   5. Installation requirements common to piping and equipment specification Sections.
   6. Plumbing demolition.
   7. Piping tests.

1.03 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

C. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.04 SUBMITTALS

A. Submittals:
   1. General: Submit the following according to the Conditions of the Contract.
   2. Product data for following piping specialties:
      a. Valves.
      b. Pressure gauges.
      c. Identification materials and devices.

1.05 QUALITY ASSURANCE

A. All plumbing piping, fixtures, specialties, equipment and connections shall be installed per requirements of the applicable code.

B. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions."

D. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves."

E. FCI Compliance: Test and rate Y-type strainers in accordance with FCI 73-I "Pressure Rating Standard for Y-type strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than Y-type".

F. UL and FM Compliance: Provide meters, gauges, and supports which are UL-listed and FM approved.

G. MSS Standard Compliance: Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

H. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

I. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements. No additional cost will be approved for any such changes.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate plumbing fixture and equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of plumbing systems with exterior site utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where plumbing items requiring access are concealed behind finished surfaces.

H. Perform demolition and new plumbing work in phases as indicated.

1.08 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition:
   1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
   2. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

B. Conditions Affecting Excavations:
   1. Maintain and protect existing building services which transit the area affected by excavations.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
4. Remove existing underground utilities indicated to be removed.
   a. Uncharted or Incorrectly Charted Utilities: Contact Utility Owner immediately for instructions.
   b. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Owner and Engineer prior to utility interruption.
5. Use of explosives is not permitted.

PART 2 PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. For pipe and fitting materials and joining methods refer to plumbing piping system specification sections.

2.02 VALVES

A. General: Provide factory-fabricated valves recommended by Manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with Installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Ball Valves: Comply with the following requirements:
   1. Ball valves - 1-inch and Smaller:
      a. Rated for 150 PSI SWP pressure, 600 PSI non-shock WOG pressure;
      b. 2-piece construction, bronze body conforming to ASTM B 584 or B61, full port.
      c. 316 stainless steel ball
      d. Reinforced "Teflon" or "TFE" seats and seals
      e. Blowout proof stem
      f. Vinyl-covered steel handle.
      g. Extended solder ends for domestic hot and cold water service.
      h. 2-inch extended handles of non-thermal conductive material. Valve pressure ratings shall be cast into the body of the valve.
   2. Ball Valves - 1-1/4-Inches to 2-Inches:
      a. Rated for 150 PSI SWP pressure, 600 PSI non-shock WOG pressure.
      b. 2-piece construction, bronze body conforming to ASTM B 584 or B61, full port.
      c. 316 stainless steel ball.
      d. reinforced and replaceable "Teflon" or "TFE" seats and seals.
      e. Blowout proof stem.
      f. Vinyl-covered steel handle.
      g. Extended solder ends for domestic hot and cold water service.
      h. 2-inch extended handles of non-thermal conductive material.
      i. Valve pressure ratings shall be cast into the body of the valve.

2.03 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags for all valves with stamp-engraved piping system abbreviation in 1/4-inch high letters and sequenced valve numbers 1/2-inch high, and with 5/32-inch hole for fastener.
   1. Provide 1-1/2-inch diameter tags, except as otherwise indicated.
   2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.04 VALVE SCHEDULES

A. General: Provide a valve schedule for each piping system in electronic form and printed out on standard size bond paper for inclusion in Operation and Maintenance manual.
   1. Schedule shall include valve identification number, piping system, size and location of valve, normal operating position and additional remarks as required.
   2. Identify valve use for emergency shutoff or similar special use.

2.05 SUPPORTS AND ANCHORS

A. Horizontal-Piping Hangers and Supports:
   1. General: Provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information.
   2. Adjustable Steel Clevis Hangers: MSS Type 1.
   3. Yoke Type Pipe Clamps: MSS Type 2.
   4. Steel Double Bolt Pipe Clamps: MSS Type 3.
   5. Steel Pipe Clamps: MSS Type 4.
   6. Pipe Hangers: MSS Type 5.
   7. Trapeze type with horizontal angle iron.
   8. Use only one type by one manufacturer for each piping service.
   9. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
   10. Provide copper-plated hangers and supports for copper-piping systems.

B. Saddles and Shields:
   1. General: Provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
   2. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
   3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
   4. Thermal Hanger Shields: Constructed of 360 degree insert of high density, 100 PSI, water-proofed calcium silicate, encased in 360 degree sheet metal shield. Provide assembly of same thickness as adjoining insulation.

2.06 PLUMBING IDENTIFICATION

A. Equipment Markers:
   1. General: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive or fasteners to mount on equipment.
   2. Terminology: Match drawing schedules as closely as possible unless directed otherwise by Owner.
   3. Data Required:
      a. Equipment Description, (i.e. Domestic Water Heater).
      b. Schedule Mark, (i.e. DWH-1).
   4. Marker Size: 2-1/2- by 4-inches for main control valves; 4-1/2- by 6-inches for equipment.

B. Plastic Pipe Markers:
   1. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
   2. Small Pipes: For external diameters less than 6-inches (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by the following method:
      a. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2-inches.

3. Large Pipes: For external diameters of 6-inch and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than three times letter height (and of required length), fastened by one of the following methods:
   a. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2-inches wide, full circle at both ends of pipe marker, tape lapped 3 inches.
4. Lettering: Comply with piping system nomenclature as specified, scheduled or shown on drawings, and abbreviate only as necessary for each application length.
   a. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. Plastic Tape:
1. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick, complying with ANSI A13.1.
2. Width: Provide 1-1/2-inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6-inches, 2-1/2-inch wide tape for larger pipes.

D. Color Scheme: Comply with ANSI A13.1, or as scheduled below:

PIPE CONTENTS	COLOR SCHEME
Domestic Cold Water	White text on Green

2.7 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:
1. One-part, non-acid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and non-porous joint substrates; formulated with fungicide; intended for sealing interior joints with non-porous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

D. Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5%.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistant ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

PART 3 EXECUTION

3.01 PIPING SYSTEMS-COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise.

B. General Locations and Arrangements: Drawings (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, except where deviations to layout are approved on coordination drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Transition Fitting Installation:
   1. Install transition couplings at joints of dissimilar piping.
   2. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.
      a. Dielectric Fitting Installation:
         1) Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
         2) Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
         3) Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
         4) Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

M. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
   1. Install steel pipe for sleeves smaller than 6-inch.
   2. Install cast-iron wall pipes for sleeves 6-inch and larger.
   3. Assemble and install mechanical seals according to manufacturer's printed instructions.

N. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
   4. 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 inside diameter. Join pipe fittings and valves as follows:
      a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
      c. Align threads at point of assembly.
      d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
      e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
   5. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to the "Quality Assurance" Article.
   6. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble

joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

7. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
   a. Comply with ASTM F 402 for safe handling of solvent-cement and primers.
   b. Chlorinated Polyvinylchloride (CPVC): ASTM D 2846 and ASTM F 493.
   c. Polyvinylchloride (PVC) Pressure Application: ASTM D 2672.
   d. Polyvinylchloride (PVC) Non-Pressure Application: ASTM D 2855.
8. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.
   a. Plain-End Pipe and Fittings: Butt joining.
   b. Plain-End Pipe and Socket-Type Fittings: Socket joining.

O. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
   1. Install unions in piping 2-inch and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
   2. Install flanges in piping 2-1/2-inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
   3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
   4. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
   5. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces.
   6. Install isolation valves upstream of all dielectric unions and flanges.

3.02 VALVE INSTALLATIONS

A. General Application: Use ball and butterfly valves for shut-off duty; globe, ball, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Locate valves for easy access.

G. Install valves in horizontal piping with stem at or above the center of the pipe, and to allow full stem movement.

H. 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.

I. Valve Locations:
   1. Plumbing Piping:
      a. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.
      b. Shut-off Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
      c. Throttling Valves: As required on plans.

2. Valve Tags:
   a. Provide valve tags for all valves and list on Valve Schedule.
   b. Install tags on valves in piping systems, except check valves, valves within factory-fabricated equipment units and plumbing fixture supply stops.

J. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

K. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.03 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

	VALVES 2-INCHES AND SMALLER			
SERVICE	GATE	GLOBE	BALL	CHECK
Domestic Hot & Cold Water	125	125	150	125
	VALVES 2-1/2-INCHES AND LARGER			
SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
Domestic Hot & Cold Water	125	125	200	125

3.04 DOMESTIC WATER VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
   2. Drain Duty: Hose-end drain valves.

3.05 PIPING SPECIALTIES INSTALLATION

A. Dielectric Unions: Install at each piping joint between ferrous and nonferrous piping. Comply with manufacturer's installation instructions.
   1. Install isolation valves on each side of all dielectric unions.

3.06 SUPPORTS AND ANCHORS INSTALLATION

A. Hangers and Supports:
   1. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69.
      a. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69.
      b. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
      c. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
      d. Do not support piping from bottom cord of bar joist or from metal roof deck, unless approved by Structural Engineer.
      e. Piping may be supported at panel points of bar joists.
   2. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. For exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent and similar piping.
   3. Use powder-actuated fasteners only for installation where load will be applied perpendicular to the fasteners. Do not use powder-actuated fasteners where load will be applied axially to the fasteners.
   4. Support fire-water piping independently of other piping.

5. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

B. Saddles and Shields:
   1. Insulated Piping: Comply with the following installation requirements:
      a. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold water piping, install coated protective shields. For pipe 8-inch and over, install wood insulation saddles.
      b. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

C. Pipe hanger and support products.
   1. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet Requiring Vibration Isolation: MSS Type 49, spring cushion rolls.
   2. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   3. Vertical Piping: MSS Type 8 or 42, clamps.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8-inch.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60-inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72-inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96-inches with 3/8-inch rod.
   4. NPS 2-1/2: 108-inches with 1/2-inch rod.
   5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
   6. NPS 6: 10 feet with 5/8-inch rod.
   7. NPS 8: 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 and Smaller: 84-inches with 3/8-inch rod.
   2. NPS 1-1/2: 108-inches with 3/8-inch rod.
   3. NPS 2: 10 feet with 3/8-inch rod.
   4. NPS 2-1/2: 11 feet with 1/2-inch rod.
   5. NPS 3: 12 feet with 1/2-inch rod.
   6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
   7. NPS 6: 12 feet with 3/4-inch rod.
   8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical steel piping every 15 feet.

J. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2 and Smaller: 48-inches with 3/8-inch rod.
   2. NPS 2-1/2 to NPS 3: 48-inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 48-inches with 5/8-inch rod.
   4. NPS 6: 48-inches with 3/4-inch rod.
   5. NPS 8: 48-inches with 7/8-inch rod.

K. Install supports for vertical PVC piping every 48 inches.

L. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60-inches with 3/8-inch rod.
   2. NPS 3: 60-inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60-inches with 5/8-inch rod.
   4. NPS 6: 60-inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60-inches with 7/8-inch rod.

M. Install supports for vertical cast-iron soil piping every 15 feet.

N. Install vinyl-coated hangers for PEX tubing at 32-inches maximum horizontal spacing with 3/8-inch rod.

O. Install supports for vertical PEX tubing every 48-inches.

P. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 PLUMBING IDENTIFICATION INSTALLATION

A. Install equipment markers with permanent adhesive or appropriate fasteners on or near each major item of mechanical equipment
   1. Locate markers where accessible and visible.
   2. Include markers for the following categories of equipment:
      a. Main control and operating valves.
      b. Pumps, water heaters, tanks, pressure vessels, humidifiers, water-treatment systems, and similar equipment.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be question of flow pattern.
   3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   4. At access doors, manholes and similar access points which permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced intermediately at maximum spacing of 50-feet along each piping run, except reduce spacing to 25-feet in congested areas of piping and equipment.
   7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code-Steel."

3.9 SELECTIVE DEMOLITION

A. General: Demolish, remove, demount, and disconnect abandoned plumbing piping, materials and equipment indicated to be removed and not indicated to be salvaged or saved.

B. Materials and Equipment designated for Salvage: Remove, demount, and disconnect existing plumbing materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage by Owner.

C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

D. Plumbing Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

1. Inactive and obsolete piping, fittings and specialties, equipment, controls, fixtures, and insulation.
   a. Piping embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping allowed to remain.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for plumbing installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.11 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.12 PIPING TESTS

A. No piping work, fixtures, or equipment shall be concealed or covered until they have been observed by the Engineer's representative, who shall be notified by the Contractor when the work is ready for inspection. All work shall be completely installed, tested as required by this Section and by all applicable local and State Ordinances and Safety Orders, and shall be leak-tight before inspection is requested. All tests shall be repeated upon request to the satisfaction of those making the inspection.

B. All domestic water piping shall be flushed, tested and shall be left under pressure of supply main or a minimum of 40 PSI for the balance of the construction period.

C. Piping tests shall be made with the test medium and under test pressures listed in the following table. Use a calibrated Bristol Pressure Recorder, or equal, on all tests. Engineer's representative shall install and remove each chart. Recorder range shall be 0-300 pounds or required range for specific test.

PIPING TESTS

Type of Piping	Test Pressure	Test Medium	Test Period
Domestic Water			
1. Pressure Regulated to and including 80 PSI	150 PSIG	Water	Two Hours

D. Test pressure in lbs. per square inch, or inches of vacuum, gauge, are given as an initial pressure to be applied to lines being tested, together with test medium.

E. Final pressures at the end of test period shall be no more or less than that caused by expansion or contraction of the test medium due to temperature changes.

F. Check of systems during application of test pressures should include visual check for water medium leakage and soap bubble or similar for air and nitrogen medium.

G. During heating and cooling cycles, linear expansion shall be checked at all elbows, U-bends, expansion joints, etc., for proper clearance.

END OF SECTION

SECTION 22 0700
PLUMBING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Plumbing Insulation.
   2. Insulation Accessories.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation and accessory.
   1. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

1.04 QUALITY ASSURANCE

A. Furnish insulation and materials bearing the manufacturer's label. Only mechanics skilled at such work shall apply materials. Insulation and materials shall be by one of the manufacturers listed. Specialty material shall be of the manufacturer indicated or approved equal. Fire and smoke hazard classification ratings on insulation, jacket, and adhesive shall conform to NFPA 255, ASTM E 84, or UL-723 as follows:
   1. Flame Spread Index not exceeding 25.
   2. Smoke Developed Index not exceeding 50.

B. Certifications: Submit certifications or other data as necessary to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.05 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.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one (1) of the following:
   1. Armacell LLC.
   2. Dow Chemical Company.
   3. Johns-Manville Corp.
   4. Keene Corp.

5. Knauf Fiber Glass.
6. Nomaco K-Flex.
7. Owens-Corning Fiberglass Corp.
8. Pittsburg Corning Corp.

2.02 MATERIALS

A. Thermal Conductivity Average Maximum in Btu-in/hr-ft² at 75ºF Mean Temperature:
   1. Fiberglass Board = 0.26.
   2. Fiberglass Blanket = 0.30.
   3. Fiberglass Preformed Pipe Insulation = 0.26.
   4. Cellular Glass = 0.30.
   5. Flexible Elastomeric Cellular = 0.27.
   6. Polyisocyanurate = 0.19.
   7. Calcium Silicate = 0.60 @ 500ºF.

B. Vapor retarder film and tape shall have a maximum permeance of 0.030 perm.

C. Provide pre-formed fiberglass and elastomeric closed-cell plastic foam pipe insulation with self-adhering and self-sealing overlapping flap.

PART 3 EXECUTION

3.01 PIPING INSULATION SCHEDULE

A. Exposed Piping.
   1. Pipe insulation exposed in finished areas shall be protected with 0.030-inches thick PVC plastic jacketing covers, Ceel-Co 100 Series or approved equal.
   2. Pipe insulation exposed in mechanical and electrical equipment rooms, indoor parking garages and other unfinished areas 8-feet 0-inches or less above finish floor shall be protected with 0.030-inches thick, ultraviolet resistant, PVC plastic jacketing covers, Ceel-Co 300 Series or approved equal.
   3. Pipe insulation exposed to weather or abuse shall be protected with a factory-fabricated aluminum jacket, 0.032-inch thick. Moisture barrier membrane for insulation exposed to weather shall be 3-mil thick polyethylene and kraft paper, installed according to manufacturer's recommendations for the application at hand.

B. Domestic Cold Water - 1-1/4-inch and smaller.
   1. Fiberglass: 1/2-inch thick 4-pcf density with fire-resistive ASJ vapor barrier jacket.
   2. Elastomeric closed-cell plastic foam: 1/2-inch thick.
   3. Polyisocyanurate closed-cell: 1-inch thick with vapor retarder film.

C. Domestic Cold Water - 1-1/2-inch and larger.
   1. Fiberglass: 1-inch thick 4-pcf density with fire-resistive ASJ vapor barrier jacket.
   2. Elastomeric closed-cell plastic foam: 1-inch thick.
   3. Polyisocyanurate closed-cell: 1-inch thick with vapor retarder film.

3.02 EXAMINATION

A. Examine substrates and condition for compliance with requirements for installation 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.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with the MICA National Commercial and Industrial Insulation Standards to ensure that insulation serves its intended purpose.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and piping including fittings, valves, and specialties.

C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.

D. 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.

E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

F. Install multiple layers of insulation with longitudinal and end seams staggered.

G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

H. Keep insulation materials dry during application and finishing.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.

K. 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.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

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. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

P. Provide neatly beveled edge at interruptions of insulation.

3.05 INSTALLATION OF PIPING INSULATION

A. Install insulation on pipe systems subsequent to testing and acceptance of tests.

B. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. The appearance of the completed insulation shall be a significant factor in determining the acceptability of the work.

C. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

E. Where vapor retarders are specified, elbows and fittings shall be wrapped with vapor retarder tape 3-inches wide or shall have PVC jacketing.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation applied to adjoining pipe run. Install factory-molded, pre-cut or job-fabricated units (at installer's option) except where specific form or type is indicated.

G. Insulation of Piping Specialties on Cold Piping Services: Insulate union, flanges, strainers, flexible connections, hoses, and expansion joints on cold piping services with flexible elastomeric cellular insulation. Thickness of flexible elastomeric cellular insulation shall be equivalent to thickness of insulation on the piping service as specified in this Section or as shown on the drawings. Insulation shall be sealed to provide a vapor tight barrier. Cold piping services include domestic cold water systems.

H. Piping Insulation Omitted: Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture; on unions, flanges, strainers, flexible connections, and expansion joints.

I. Insulated piping systems shall be supported on the exterior of the insulation surface. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.

J. Metal shields: Conform to table below for minimum length of shield:

PIPE SIZE	INSULATION THICKNESS	LENGTH OF SHIELD
Less than 1"	Up to 1"	3"
1"-2"	1"	4-1/2"
2-1/2"-4"	1"	6-1/2"
5" and Larger	1"	13"

K. Pipe Hanger, Trapeze, and Roller Support Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. Apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3-inch wide vapor barrier tape or band.

3.06 PROTECTION AND REPLACEMENT

A. Protection: Provide protection for insulation work during remainder of construction period, to avoid damage and deterioration.

B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

END OF SECTION

SECTION 22 1116
PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes piping tubing and fittings inside building:
   1. Domestic water.
   2. Connectors.
   3. Hangers and supports.

1.03 SUBMITTALS

A. Product Data: For the following products:
   1. Pipe
   2. Fittings.
   3. Connectors.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 PRODUCTS

2.01 JOINING MATERIALS

A. Solder Filler Metal: ASTM B 32.
   1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95%) and silver (approximately 5%), having 0.10% lead content.
   2. Alloy Sn50: Tin (50%) and lead (50%) (for use on nonpotable water systems only).

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
   1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
   3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
   1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

PART 3 EXECUTION

3.01 GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of plumbing piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

3.02 DOMESTIC WATER PIPING INSTALLATION

A. Install domestic water piping level and plumb.

B. Install piping concealed from view and protected from physical contact by building occupants except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

E. Install piping adjacent to equipment and specialties to allow service and maintenance.

F. Install piping to permit valve servicing.

G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

K. Install escutcheons for piping penetrations of walls, ceilings, floors, cabinetry and casework.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 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 pipes, tubes, 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.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 CONNECTIONS

A. General:
   1. Install piping adjacent to equipment, appliances, fixtures and machines to allow service and maintenance.
   2. Use transition fitting to join dissimilar piping materials.

B. Connect domestic water piping water-service main to exterior water-service piping with shutoff valve.
   1. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

C. Connections to equipment and fixtures furnished by others:
   1. Provide rough-in connections, P-traps, tailpieces, supplies and stops as required for connection to the plumbing system.
   2. Pipes and fittings exposed in finished areas shall be chrome plated.

3.05 EXISTING TO REMAIN PIPING

A. Inspect all existing to remain piping within building for blockage or existing damage.

B. Alert GC/Owner of any existing piping system damage prior to performing any work associated with repairs.

C. Failure to alert owner/GC prior to start of work may result in additional services being denied for work not given prior approval.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one (1) day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Test domestic water piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 PSIG above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

D. Plumbing piping shall be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.07 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.

4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 PPM of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of piping system. Remove dirt and debris as work progresses.

E. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

F. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING APPLICATIONS

A. General:
   1. Pipe material selected shall be in compliance with all applicable codes.
   2. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   3. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
   4. Fitting Option: Extruded-tee connections with brazed joints may be used on aboveground copper tubing.

B. Domestic Water:
   1. Aboveground domestic water piping shall be one of the following:
      a. Hard copper tube, ASTM B 88, Type L wrought-copper solder-joint fittings; and soldered joints.

b. Tube Size 2-1/2-inch and larger only: Hard copper tube, ASTM B 88, Type L, grooved joint; grooved joint couplings and fittings.

END OF SECTION

SECTION 22 1119
PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following plumbing specialties:
   1. Pressure Reducing and regulator valves.

1.03 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Plumbing Specialties: 125 PSIG, unless otherwise indicated.

1.04 SUBMITTALS

A. Shop Drawing Submittals:
   1. Product Data: For each type of product indicated.
   2. Shop Drawings: Diagram power, signal, and control wiring.

B. Closeout Submittals:
   1. Operation and Maintenance Data: For plumbing specialties to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

B. Reduced-Pressure-Principle Backflow Preventers shall be listed as approved by the University of Southern California Foundation for Cross Connection Control and shall be approved by the local water utility provider.

C. 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.

D. NSF Compliance:
   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 PRODUCTS

2.01 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
      a. Watts Industries, Inc.; Water Products Div.
      b. Zurn Plumbing Products Group; Wilkins Div.
   2. Standard: ASSE 1013.
   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 12 PSIG maximum, through middle 1/3 of flow range.
   5. Body: Bronze for NPS 2 and smaller; epoxy coated ductile iron for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.02 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   a. Honeywell Water Controls.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 PSIG.
4. Body: Bronze [with chrome-plated finish] for NPS 2 and smaller; cast iron [with interior lining complying with AWWA C550 or that is FDA approved] for NPS 2-1/2 and NPS 3.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.03 HEAT TRACING SYSTEMS

A. Systems shall meet requirements of NFPA 70.

B. Provide tracing for outdoor piping subject to freezing temperatures below 38 degrees F as follows:

1. Condenser water piping for cooling towers.
2. Make-up water.

C. Heat tracing shall be provided to the extent shown in the contract documents.

D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.

1. Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.
2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 36 degrees F minimum during winter outdoor design temperature, but not less than the following:
   a. 3 inch pipe and smaller with 1 inch thick insulation: 4 watts per foot of pipe.
   b. 4 inch pipe and larger 1-1/2 inch thick insulation: 8 watts per feet of pipe.

E. Electrical Heating Tracing Accessories:

1. Power supply connection fitting and stainless-steel mounting brackets. Provide stainless-steel worm gear clamp to fasten bracket to pipe.
2. 1/2 inch wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 12 inch intervals.
3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 1/2 inch NPT conduit hub, SPST switch rated 20 amps at 480 volts ac,

with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 34 degrees F.

4. Signs: Manufacturer's standard (NFPA 70), stamped "ELECTRIC TRACED" located on the insulation jacket at 10 feet intervals along the pipe on alternating sides.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install water control valves with inlet and outlet shutoff valves [and bypass with globe valve]. Install pressure gages on inlet and outlet.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets

3.02 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Primary, thermostatic, water mixing valves.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.05 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

3.06 PROTECTION

A. Protect drains during construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 23 0000
HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes general requirements for HVAC systems and HVAC motors.

1.03 CONTRACT DOCUMENT COORDINATION

A. Contract Documents are diagrammatic in showing certain physical relationships between architectural, structural, mechanical, plumbing and electrical work.
   1. Verification and coordination of these relationships is the responsibility of the Contractor.
   2. Contractor shall verify existing conditions before starting work.
   3. Floor plan drawings do not necessarily indicate all required offsets, fittings, valves, etc.
   4. Provide all necessary piping, fittings, valves, ducts, offsets, and other specialties required without additional cost to the Owner.

B. Should Contract Document requirements appear to make it impossible to provide a complete and operational system, or should discrepancies appear among Contract Documents, Contractor shall request clarification before proceeding with work.

1.04 QUALITY ASSURANCE

A. Comply with all State, and local codes and ordinances.

B. Obtain and pay for all required permits, fees and certificates of inspection of the work.

C. Install equipment and devices to provide required access for servicing and maintenance.

D. Mechanical Code Compliance: Comply with applicable portions of Local, City, and State Mechanical Code pertaining to mechanical materials construction and installation of products.

1.05 SUBMITTALS

A. General: See Division 01, Section Submittal Procedures.
   1. Shop Drawing Submittals shall include specially prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information.
   2. Shop Drawing Submittals may also include product data which includes standard printed information on materials, products and systems; not specially prepared for this project, but with the designation of selections from among available choices for this project clearly identified.

B. Submittal Requirements:
   1. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect/Engineer's review with another.
   2. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name, specification section and similar information to distinguish it from other submittals.
   3. Provide General Contractor’s and Subcontractor’s stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Contract Documents. Submittals which are received from sources other than through Contractor's office will be returned by Architect/Engineer "Without Action".

4. Items from each specification section shall be prepared as separate submittals, not grouped or bound with other items. Submittals shall clearly indicate the applicable specification section.

C. Alternate Equipment Submittal by Contractor:
   1. Equipment of greater or larger dimensions, weight, capacity, or rated performance than that which is specified may be submitted provided all connecting mechanical and electrical services, including ductwork and piping connections, circuit breakers, electrical conduit and conductors, motors, equipment supports, building structure, and equipment spaces are modified as required by the proposed equipment. If performance ratings or efficiencies of the equipment are specified, the equipment must meet or exceed these design requirements as well as any specified commissioning requirements. **NO ADDITIONAL COST WILL BE APPROVED FOR ANY SUCH CHANGES RELATED TO THE ALTERNATE EQUIPMENT.**
   2. Should proposed alternate equipment involve rearrangement of other designed equipment, a complete layout of the area involved shall be submitted by the Contractor along with the alternate equipment submittal, and shall be approved in writing by the Architect/Engineer prior to ordering, purchasing, delivery or installation of any such items of equipment.
   3. **CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ADDITIONAL EXPENSE AND COORDINATION WITH OTHER TRADES RESULTING FROM THE SUBSTITUTION OF EQUIPMENT OTHER THAN THAT SPECIFIED IN THE CONTRACT DOCUMENTS.**

D. Submittal Review:
   1. Review of submittal data is only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the plans and specifications.
   2. Review of shop drawings does not release the Contractor from further satisfactory equipment operating responsibilities. Equipment shall be approved for final acceptance when installation is completed and all equipment and systems have been operated, tested, adjusted and balanced in compliance with the contract documents.
   3. Re-submittals: When revised for resubmission, clearly indicate all changes since previous submission. Only those items required to be resubmitted shall be included.

E. Operation and Maintenance (O&M) Manuals:
   1. Prepare and submit three (3) copies of operation and maintenance instructions for all Division 23 equipment furnished.
      a. Provide individual 3-ring binders with a table of contents and tabbed sections for each specification section.
      b. Identify equipment included in the manuals by the equipment mark used in the contract drawings.
      c. Include emergency instructions, spare parts listing, copies of warranties, wiring diagrams, shop drawings, product data, signed letters of certification of inspection and similar information.
      d. Provide documentation that training was performed for each item specified to include Owner training. Include name of Owner's representative(s) present, date and time of training.
      e. Provide a list of manufacturer's representatives for each item of equipment including company name, address and phone number.
      f. Provide documentation that Extra Materials were received by the Owner for each section requiring Extra Materials.
   2. All information contained in equipment manufacturer's operation and maintenance manual shall be specific to equipment provided. Contractor shall mark out or not include all unrelated information.
   3. Electronic O&M Manuals: Provide electronic version of project O&M Manuals in pdf format in addition to hardcopy version of the manuals.

F. Required Submittals List:
   1. Shop Drawings shall be submitted for the items listed in each section of the specifications. Submittals in addition to those listed may be required by the Architect/Engineer.

1.06 RECORD DRAWINGS

A. See Division 01, Section Project Record Documents.

B. Provide a set of mechanical drawings marked-up with actual as-built conditions for Division 23 work. Record drawings shall include all addenda and change orders.

1.07 CONTRACT DRAWING FILE REQUESTS

A. As an instrument of service to aid in Shop Drawing Submittals, Farris Engineering (FEI) will provide AutoCAD drawing files upon request. The files will be sent upon return receipt of the "Request for Drawings" agreement signed by an officer of the requesting firm. FEI does not assure that the drawings represent all changes, addenda items, change orders or modifications that may have occurred. The drawings are simply a tool for use in producing shop drawing submittals. The drawing files will be "cleaned-up" by having the FEI logo, Professional Engineer seal, and all extraneous notes and details removed. FEI must be compensated for this additional service by the requesting firm. A minimum fee of $400.00 for up to eight (8) sheets and $50.00 per sheet for each additional requested drawing will be invoiced to the requesting firm once the signed agreement is received.

1.08 MECHANICAL/ELECTRICAL COORDINATION

A. General: See Division 01, Multiple Contract Summary.

B. Mechanical Contractor shall coordinate with Electrical Contractor and verify that proper electrical power connections to mechanical equipment which requires electrical power is provided. Unless specifically shown otherwise Electrical Contractor shall provide power connections to the equipment and Mechanical Contractor shall provide wiring required for start-stop, temperature control and safety interlock functions.

C. If mechanical contractor has proposed alternate equipment to that specified in the contract documents, and such alternate equipment requires modified electrical power connections, mechanical contractor shall coordinate these requirements with electrical contractor prior to ordering, purchasing, delivery or installation of any electrical conduits, conductors, circuit breakers and other electrical devices serving the alternate equipment.

D. Types of work, normally recognized as electrical but provided as mechanical include but are not necessarily limited to the following:
   1. Motors for mechanical equipment.
   2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
   3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, when specifically indicated to be furnished integrally with equipment.
   4. Electrical power connections for mechanical equipment that are not indicated on the electrical drawings.

1.09 ELECTRIC MOTORS

A. Basic Motor Requirements
   1. Motors smaller than 1 HP: Single-phase.
   2. Motors 1 HP and Larger: Polyphase.
   3. Frequency Rating: 60 Hz.
   4. Voltage Rating: Determined by voltage of circuit to which motor is connected.
   5. Service Factor: According to NEMA MG-1, unless otherwise indicated.
   6. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment,

with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

7. Enclosure: Open drip proof unless otherwise indicated.

1.10 FINAL COMPLETION

A. The Mechanical Contractor shall not call for a final completion check until all Mechanical Systems have been installed, adjusted, tested, and balanced and in full and complete satisfactory operation and the following certifications of inspection from equipment suppliers have been completed. Certifications of Inspection are required on the following equipment:
   1. Temperature Control Equipment.
   2. Variable Frequency Controllers.
   3. Cooling Towers.

B. Certifications of Inspection shall consist of letters signed by Factory-Trained and -Authorized Service Personnel stating the following:
   1. They have inspected all of their equipment on the project.
   2. They approve the condition of the equipment and its installation.
   3. They have fully checked its operation and certify that it is operating properly.
   4. They have noted any problems, conditions or objections that could lead to future operating problems.

C. Documentation of the signed letters of Certification of Inspection shall be furnished in the Operations and Maintenance Manuals, included with the associated equipment.

1.11 GUARANTEE

A. The one year guarantee period shall not start until the project is fully completed and the Contractor has received the Final Payment and Certificate of Completion.

B. All equipment and all work shall be fully guaranteed, parts and labor, for one full year from the date of the Certificate of Completion. Repairs made during this period must be fully guaranteed for an additional one year period from the date of repairs.

C. The Mechanical Contractor has the full responsibility to guarantee all equipment and work and shall assume full responsibility to repair any equipment at his cost that the manufacturer refuses to guarantee.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 ELECTRICAL WORK PROVIDED BY MECHANICAL

A. All electrical equipment provided and the wiring and installation of electrical equipment shall be in accordance with the requirements of the equipment manufacturer, this Section and Division 26.

3.02 PIPE HANGING AND SUPPORT

A. All piping systems shall be supported from building structural systems capable of supporting the applied load.

B. Piping shall not be supported from metal roof decking.

3.03 PAINTING AND FINISHING

A. Painting of exposed mechanical work is specified and performed under other divisions of these specifications, or as indicated on the drawings.

B. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish at the time of final inspection.

C. Paint inside of ductwork black, where it can be seen from occupied spaces through diffusers, grilles or louvers (under any lighting condition).

3.04 WORK IN EXISTING BUILDINGS

A. Work under this Contract includes additions and/or renovations to an existing building. It shall be the responsibility of each Bidder to fully inform himself of all conditions which affect the work contemplated by these specifications and accompanying drawings. The submission of proposal by any Bidder will be construed as an admission by him that he has examined and is fully familiar with the premises and all conditions thereon and adjacent thereto, and has included in this proposal a proper and adequate amount to cover rearrangement of existing work for the proper installation and operation of the new and existing equipment as shown on the drawings or as required by these specifications. Such work shall be neatly and properly done.

B. Maintain existing mechanical services to occupied areas and operational facilities unless otherwise indicated or when otherwise authorized in writing by Owner and Architect.

C. The operation of all existing equipment, fixtures and devices designated to remain shall be maintained. Provide temporary connections and devices as necessary to maintain the proper operation of the equipment designated to remain if required during construction.

3.05 REBATES

A. Contractor shall assist the Owner with filing of applicable forms to obtain rebates. This shall include but not be limited to determination of qualifying equipment and materials and furnishing invoices for equipment and materials as required to support the rebate application.

END OF SECTION

SECTION 23 0010
MECHANICAL SUBMITTALS

PART 1 GENERAL

1.01 GENERAL

A. Submittals shall include specially prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.

B. Submittals shall also include product data which includes standard printed information on materials, products and systems; not specially prepared for this project, but with the designation of selections from among available choices for this project clearly identified.

1.02 SUBMITTAL REQUIREMENTS

A. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect/Engineer's review with another.

B. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and providing space for Architect's/Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through Contractor's office will be returned by Architect/Engineer "Without Action".

C. Provide Contractor's certification on form, ready for execution, stating that information submitted complies with requirements of contract documents.

D. The Contractor shall be responsible for and bear any expense of alterations to the building or its appurtenances resulting from the substitution of equipment to that specified in the Contract Documents.

E. Review of submittals does not release the Contractor from further satisfactory operating responsibilities. Material and equipment shall be approved for final acceptance when construction is completed and all units and systems have been operated, tested, adjusted and balanced to the satisfaction of the Architect/Engineer. Should proposed approved alternate equipment involve rearrangement of designed equipment, a complete layout of the area involved shall be submitted by the Contractor, and shall be approved in writing before installation of any such items of equipment. Any additional expense involved shall be a Contractor-borne expense.

F. Electronic Submittals: All submittals for shop drawings, O & M Manuals and Record Drawings shall be in electronic PDF format. 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., North HS-23 05 00). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., North HS-23 05 00-A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and/or Construction Manager.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Architect, Engineer and Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.
   h. Category and type of submittal.
   i. Submittal purpose and description.
   j. Specification Section number and title.
   k. Specification paragraph number or drawing designation and generic name for each of multiple items.
   l. Drawing number and detail references, as appropriate.
   m. Location(s) where product is to be installed, as appropriate.
   n. Related physical samples submitted directly.
   o. Indication of full or partial submittal.
   p. Transmittal number, numbered consecutively.
   q. Submittal and transmittal distribution record.
   r. Other necessary identification.
   s. Remarks.

1.03 SUBMITTAL LIST

A. Submittals shall be submitted for, but not limited to, the items listed in each section of the specifications. Submittals, in addition to those listed, may be required by the Architect/Engineer. The following submittal register is a summary list of submittals required for the project.

SUBMITTAL REGISTER	
SECTION	ITEM
23 0000	O&M Manuals
23 0000	Record Drawings
23 0000	Certification of Inspection
23 0500	Valves
23 0500	Meters and Gauges
23 0500	Supports and Anchors
23 0500	Mechanical Identification
23 0500	Vibration Control
23 0500	Joint Sealants
23 0593	Test & Balance Report
23 0700	HVAC Insulation Materials Schedule
23 0915	Variable Frequency Drives
23 0990	HVAC Instrumentation and Controls
23 0993	Sequence of Operation
23 2113	Hydronic Piping & Fittings
23 2500	Hydronic System Cleaning & Treatment

SUBMITTAL REGISTER	
SECTION	ITEM
23 6500	Cooling Tower and Accessories

END OF SECTION

SECTION 23 0915

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 WORK INCLUDED

A. Extent of variable frequency drives work is indicated by drawings and schedules and by requirements of this section.

B. The variable frequency drives for this Project shall be of the pulse width modulated type.

C. Provide the following electrical work as work of this section, in compliance with electrical specifications.
   1. Control and interlock wiring between operating controls, indicating devices, unit temperature control panels and variable frequency drive.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of variable frequency drives, of types and capacities required, where products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: A firm specializing and experienced in variable frequency drive installations for not less than five (5) years.

C. Codes and Standards:
   1. Electrical Standards: Provide electrical components of variable frequency drives which have been UL Listed and labeled, and comply with NEC Standards.
   2. NEMA Compliance: Comply with NEMA Standards pertaining to components and devices.
   3. ETL Compliance: Provide variable frequency drives with ETL approved label.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, furnished specialties, contactors and accessories; and installation and start-up instructions.

B. Coordination Data: Submit nameplate information for each motor to be operated by VFD.

C. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances and methods of assembly of components.

D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring for variable frequency drives. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.

E. Operating Conditions: Submit manufacturer's printed information clearly stating ambient temperature requirement and carrier frequency at rated conditions.

F. Maintenance Data: Submit maintenance data and parts list for each variable frequency drive, control, and accessory; including "Trouble-Shooting" Maintenance Guide. Include this data and product data in Maintenance Manual.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle variable frequency drives carefully to prevent damage, breaking, denting and scoring. Do not install damaged units or components; replace with new.

B. Store variable frequency drives in clean, dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading variable frequency drives and moving units to final location for installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide variable frequency drives from the following:
   1. Yaskawa

B. All VFD's shall be of the same manufacturer. The Contractor shall verify that the size of the equipment supplied by the selected manufacturer does not exceed the available mounting space.

C. The Contractor shall verify lead length between the VFD and associated motor. Output reactor or other device shall be provided as required to operate associated motor without damage to the motor windings.

2.02 GENERAL

A. Establish requirements for variable voltage variable frequency motor controls, for speed control of fans, blowers or pumps driven with AC motors.

B. Contractor shall coordinate exact locations of all motors controlled from a VFD and provide motors rated for VFD operation. In addition, motors shall be suitable for across-the-line starting.

2.03 VARIABLE FREQUENCY MOTOR CONTROL

A. Pulse Width Modulation VFD:
   1. The controller shall produce an adjustable AC voltage/frequency output. It should have an output voltage regulator to maintain correct output V/Hz. despite incoming voltage variations.
   2. The VFD shall be of the Pulse-Width Modulated type and shall consist of a full-wave diode bridge converter to convert incoming fixed voltage/frequency/ to a fixed DC voltage.
   3. The inverter output shall be generated by power transistors or IGBT's (isolated gate bipolar transistors).
   4. The logic control section shall be microprocessor based.

2.04 SPECIFICATION

A. Verify power input requirements with drawings.
   1. Nominal input voltage +/ - 10%
   2. Input frequency stability 48-62 HZ

B. Provide minimum 3% AC Input Line Reactor.

C. Output power; 3-phase, 1.5 to 60 Hz with variable voltage to give proper and efficient operation of variable torque load.

D. Displacement power factor - Minimum of 90% over the entire speed range.

E. VFD shall be rated for HP rating indicated on drawings. Additionally, amp rating shall not be less than National Electrical Code, Table 430-150 for corresponding HP size indicated. HP and current ratings noted above shall be minimum values after any/all derating factors such as frequency, elevation, ambient temperature, etc. have been applied. Ratings shall be based on 40°C ambient temperature and a carrier frequency of 4,500 to 8,000 KHz.

F. Minimum overload capacity of 110% for one (1) minute.

2.05 MINIMUM REQUIREMENTS FOR CONTROL OPERATION

A. Fused input door interlocked disconnect.

B. Isolated 115VAC control transformer.

C. Annunciated or digital display and time stamp of the following fault and limit functions for:
   1. Thermal overload relay trip.

2. Microprocessor self-check function.
3. Output overcurrent trip.
4. DC bus overvoltage trip.
5. Inverse time overload trip.
6. Heat sink overtemperature trip.
7. DC bus fuse open.
8. DC bus overvoltage (regen. limit).
9. Output ground fault.
10. Inverter ready light.
11. Inverter run light.
12. Inverter safety lockout light (red).
13. Power line on light.
14. Control voltage enabled light.

2.06 MINIMUM REQUIRED STANDARD FEATURES

A. Provide input disconnecting means, either a switch or circuit breaker. Disconnects shall be capable of being locked in the open position.

B. Provide VFD input fuses rated for protection of semiconductors.

C. Door Mounted Components:
   1. Inverter run indication.
   2. Digital speed (frequency or percent speed) and motor ammeter.
   3. Manual speed adjustment.
   4. Inverter / Off.
   5. Reset for fault and enable.
   6. Manual / Auto reference selector.

D. DC bus charged indicator.

E. Current limit circuit active to prevent nuisance tripping during acceleration or run conditions.

F. Regeneration limit circuit active to prevent nuisance OV tripping during deceleration.

G. Minimum and maximum speed set, separate and non-interactive.

H. Power loss restart selectable for Auto Restart in auto mode only.
   1. Automatic restart from undervoltage, power failure, or control fault or both.

I. Critical frequency lockout for up to two (2) points, available from 10% to 100% speed with at least a 6 Hz bandwidth.

J. Only non-filament type indicating lights may be used.

K. Control shall survive without component failure and annunciate output phase to phase and phase to ground faults.

L. Control shall have isolated instrument signal followers that are compatible with the temperature control system.

M. Loss of reference protection, VFD shall reset to predetermined minimum speed until such time as the control is commanded to stop or the analog reference returns to normal.

N. Control shall have available 15 selectable volts per hertz patterns.

O. Volts per hertz ratio shall be automatic, tracking motor load requirements to achieve most efficient operation within the parameters set by the volts per hertz pattern. Potentiometer adjustments not allowed.

P. VFD shall have adjustable automatic restart capabilities and be capable of starting into a spinning motor.

Q. Control must be capable of starting into a spinning motor and switching from inverter to bypass back to inverter without delay and without tripping off line of the inverter, also must be capable of stopping a motor rotating in the reverse direction and then accelerating that motor in the proper direction

R. All components must be supplied in an enclosure.

S. Manual Bypass Control. A bypass control shall be provided for the purpose of running the AC motor at full speed with line power while the VFD is being serviced. Bypass and drive shall be electrically interlocked. The VFD package shall be configured so that the VFD can be removed for service with the bypass control left in place.

T. The bypass control enclosure shall include the following:
1. NEMA 3R Enclosure
2. Door Interlock Disconnect
3. Line Select Light
4. Drive Off-line Selector
5. Power On Light
6. VFD Select Light
7. Overload Relay
8. 115 VAC Control Transformer

*VFD Input Contactor shall be manually operated.

U. System shall have an adjustable setting to allow a power line dip ride through of four (4) cycles.

V. Up to four (4) programmable pre-set speeds.

W. Drive output reference signal:
1. 0 to 10 vdc
2. 4 to 20 ma

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which variable frequency drive systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF VARIABLE FREQUENCY DRIVE SYSTEMS

A. General: Install system and materials in accordance with manufacturer's instructions and roughing-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable electrical specifications. Mount controllers at convenient locations and heights.

3.03 CLEANING

A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of variable frequency drives, including electrical connections. Report results in writing.
1. Test and adjust controls and safeties.
2. Replace damaged and malfunctioning controls and equipment.

3.05 COMMISSIONING

A. Startup Services: Engage a factory-authorized service representative to perform startup services and field report.

B. Operate motors and verify proper rotation and connections.

C. Operate controls and verify proper response to control inputs.

D. Submit a list of all adjustable and non-adjustable operating parameters along with actual settings and adjustment ranges.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
   1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.
   2. Review data in the maintenance manuals.
   3. Schedule training with Owner, through Engineer, with at least seven (7) days' advance notice.

END OF SECTION

SECTION 23 2113

HYDRONIC PIPING AND SPECIALTIES

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section includes piping systems for Cooling Tower Condenser Water Piping.

B. Types of hydronic piping and specialties specified in this section include the following:
   1. Piping and Fittings
   2. Air Vents

1.02 SUBMITTALS

A. Product Data: From manufacturer's, for each hydronic specialty and special duty valve specified, include rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions.
   1. Furnish flow and pressure drop curves for calibrated plug valves, based on manufacturer's testing.

B. Shop Drawings: Detailing dimensions, weight loadings, required clearances, methods of assembly of components, and location and size of each field connection.

C. Maintenance Data: For hydronic specialties and special duty valves, for inclusion in operation and maintenance manual.

D. Quality Control Submittals:
   1. Welders' certificates certifying that welders comply with the quality requirements specified in Quality Assurance below.
   2. Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.
   3. Submit reports specified in Part 3 of this Section.
      a. Hydronic Piping System Testing Report.
      b. Hydronic Piping System Cleaning Report.

1.03 QUALITY ASSURANCE

A. Qualifications for Welding Processes and Operators: ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification."

B. Regulatory Requirements:
   1. ASME Compliance: Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.04 MAINTENANCE

A. Maintenance Stock: Furnish a sufficient quantity of chemical for initial system start-up and for preventive maintenance for one (1) year from Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide hydronic piping system products from one (1) of the following:
   1. Grooved Mechanical Joint Pipe, Fittings, and Couplings:
      a. Gruvlok; Anvil Industries.
      b. Tyco-Grinnell
      c. Victaulic Company of America
   2. Pressfit Mechanical Joint Pipe, Fittings and Couplings:
      a. Pro Press System, Viega Company
      b. Victaulic Company of America

3. Air Vents (manual and automatic):
   a. Hays Fluid Controls
   b. TACO, Inc.
   c. Bell & Gossett
   d. Pro Hydronic Specialties

2.02 PIPE AND TUBING MATERIALS OPTIONS (SELECTED OPTIONS SHALL COMPLY WITH ALL LOCAL CODES)

A. Material Options for Cooling Tower Piping:

1. Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe: ASTM F 441, Schedule 80, plain ends.
2. Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 1785, Schedule 80, plain ends.
3. Steel Pipe, 2-1/2-inch to 12-inch NPS (DN65 to DN300): ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, plain ends with mechanical couplings (above ground only).

2.03 FITTINGS

A. Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 439 for Schedule 80 pipe.

B. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2467 for Schedule 80 pipe.

2.04 JOINING MATERIALS

A. Chlorinated Poly(Vinyl Chloride) (CPVC) Solvent Cement: ASTM F 493.

B. Poly(Vinyl Chloride) (PVC) Solvent Cement: ASTM D 2564.

2.05 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 175 PSIG working pressure, 250°F operating temperature; manually operated with screwdriver or thumbscrew; and having 1/8-inch discharge connection and 1/4-inch inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and non-ferrous internal parts; 150-PSIG working pressure, 250°F operating temperature; with 1/4-inch NPS discharge connection and 1/2-inch NPS inlet connection.

C. Scale Free System: Electronic scale free system to be installed by OPS contracted contractor at each chiller and cooling tower. Contractor to coordinate with the OPS installing contractor for timing of work. This contractor to install hot taps with ball valve at the existing chillers.

2.06 HEAT TRACING SYSTEMS

A. Systems shall meet requirements of NFPA 70.

B. Provide tracing for outdoor piping subject to freezing temperatures below 38 degrees F as follows:

1. Condenser water piping for cooling towers.
2. Make-up water.

C. Heat tracing shall be provided to the extent shown in the contract documents.

D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.

1. Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.

2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 36 degrees F minimum during winter outdoor design temperature, but not less than the following:
   a. 3 inch pipe and smaller with 1 inch thick insulation: 6 watts per foot of pipe.
   b. 4 inch pipe and larger 1-1/2 inch thick insulation: 8 watts per foot of pipe.

E. Electrical Heating Tracing Accessories:
1. Power supply connection fitting and stainless-steel mounting brackets. Provide stainless-steel worm gear clamp to fasten bracket to pipe.
2. 1/2 inch wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 12 inch intervals.
3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 1/2 inch NPT conduit hub, SPST switch rated 20 amps at 480 volts ac, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 34 degrees F.
4. Signs: Manufacturer's standard (NFPA 70), stamped "ELECTRIC TRACED" located on the insulation jacket at 10 feet intervals along the pipe on alternating sides.

PART 3 EXECUTION

3.01 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

B. Extreme care shall be exercised by the Contractor to prevent dirt and other foreign matter from entering pipe or components of system during construction. Pipe stored on Project shall have open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt removed.

C. Install piping at a uniform grade of 1-inch in 40-feet upward in the direction of flow.

D. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.

E. Install branch connections to mains using Tee fittings in main with take-off out the bottom of the main, except for up-feed risers which shall have take-off out the top of the main line.

F. Install unions in pipes 2-inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

G. Install flanges on valves, apparatus, and equipment having 2-1/2-inch and larger connections.

H. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration producing equipment.

I. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2-inch and larger.

J. Anchor piping to ensure proper direction of expansion and contraction.

K. Support: The requirements of MSS-SP-69 "Pipe Hangers and Support - Selection and Application" shall, in general, govern the installation of hangers and supports, in accordance with the manufacturer's recommendations and with the following minimum spacings:

Nominal Pipe Size (Inches)	Max. Span Between Supports (Feet)
3/4	8
1	9
1-1/4	11

1-1/2	12
2	12
2 1/2	12
3	12
4	14
5	14
6	16
8	18
10	20
12	22
16	22

3.02 VALVE APPLICATIONS

A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
   1. Shut-off duty: Use ball and butterfly valves.
   2. Throttling duty: Use ball and butterfly valves.
   3. Install shut-off duty valves at each branch connection to supply and return mains, at supply and return connection to each piece of equipment, and elsewhere as indicated.
   4. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

B. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

C. Note that all valves required by this Section may not be shown on the drawings.

3.03 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in the system, at heat transfer coils, and elsewhere as required for system air venting. For inaccessible vent locations, the vent piping shall be piped to a location where vent will be accessible.

B. Note that all hydronic specialties required by this Section may not be shown on the drawings.

3.04 FIELD QUALITY CONTROL

A. Testing Preparation: Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush system with clean water. Clean strainers.
   4. Isolate equipment that is not subjected to test pressure from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Flanged joints where blinds are inserted to isolate equipment need not be tested.
   5. Install relief 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. Testing: Test hydronic piping as follows:
   1. Use ambient temperature clean water as testing medium.
   2. Use vents installed at the high points of system to release trapped air while filling system. Use drains installed at low points for complete removal of liquid.
   3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low-pressure filling lines are disconnected.
   4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or

other component in system under test. Check to verify that stress due to pressure at bottom of vertical runs does not exceed either 90% of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, "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 as appropriate, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing and submit to Project Engineer and Owner's Representative for review. Written report shall be made available to phase 2 contractor for their final connections.

C. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens.

3.05 ADJUSTING AND CLEANING

A. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.

B. Close drains and refill systems for operation under normal closed loop conditions. HVAC Contractor shall add trisodium phosphate in an aqueous solution to system, prepared in a proportion of 1 lb/50 gallons of water in the system. After system is filled with this solution, the circulating pump should be started, trapped air vented, and the boiler set to supply approximately 100^{o}F loop temperature. Solution shall circulate for approximately three (3) hours.

C. System then shall be drained completely and refilled with fresh water. After system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable methods and left on slightly alkaline side (PH 7.5). If system is still on acid side, cleaning by use of trisodium phosphate shall be repeated.

D. Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

E. Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

3.06 COMMISSIONING

A. Fill system and perform initial chemical treatment.

B. Perform these steps before operating the system:
   1. Open valves to fully open position. Close coil bypass valves.
   2. Set automatic fill valves for required system pressure.
   3. 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).
   4. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
   5. Lubricate motors and bearings.

END OF SECTION

SECTION 23 6500
COOLING TOWERS AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Open-circuit, induced-draft, cross-flow cooling towers.
   2. Condenser water treatment.

1.03 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. Volume of water in suspension for purposes of sizing a remote storage tank.
   5. Sound power levels in eight octave bands for operation with fans off, fans at minimum, and design speed.
   6. 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).
   7. Fan airflow, brake horsepower, and drive losses.
   8. Motor amperage, efficiency, and power factor at 100%, 75%, 50%, and 25% of nameplate horsepower.
   9. 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.

C. Delegated-Design Submittal: For cooling tower support structure 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 support structure.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   3. Certificates: For certification required in "Quality Assurance" Article.
   4. Seismic Qualification Certificates: For cooling towers, accessories, and components, from manufacturers.
      a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:
1. Startup service reports.
2. Operation and Maintenance Data: For each cooling tower to include in emergency, operation, and maintenance manuals.
3. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by CTI.

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. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. ASME Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. CTI Certification: Cooling tower thermal performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."

F. FMG approval and listing in the latest edition of FMG's "Approval Guide."

1.05 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.06 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. Fan assembly including fan, drive, and motor.
2. All components of cooling tower.
3. Warranty Period: Five years from date of Substantial Completion.

1.07 SOURCE QUALITY CONTROL

A. Verification of Performance: Test and certify cooling tower performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."

B. Factory pressure test heat exchangers after fabrication and prove to be free of leaks.

PART 2 PRODUCTS

2.01 OPEN- CIRCUIT, INDUCED-DRAFT, CROSSFLOW COOLING TOWER

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:
1. Baltimore Aircoil Company.
2. Marley Cooling Technologies; an SPX Corporation.
3. Reymsa

B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.

C. Cooling tower designed to resist wind load of 30 lbf/sq. ft..

D. Casing and Frame:
1. Casing and Frame Material: Galvanized steel, ASTM A 653/A 653M, G235 coating.
2. Fasteners: Galvanized steel.

3. Joints and Seams: Sealed watertight.
4. Welded Connections: Continuous and watertight.

E. Collection Basin:
1. Material: 301L 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 B16.1, Class 125 flange.
6. Equalizer connection for field-installed equalizer piping.
7. Depressed side sump outlet with trash screen and anti-vortex plate.

F. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.

G. 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.

H. Single bottom inlet connection per cell with self-balancing 8” internal PVC piping.

I. Fill:
1. Materials: PVC, with maximum flame-spread index of 5 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.

J. Vibration Switch: For each fan drive.
1. Vibration Detection: Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
2. Switch shall, on sensing excessive vibration, shut down the fan.

K. Controls: Comply with requirements in Division 23 Section "Building Management and HVAC Control System."

L. Electrical: Provide single point power connection location with tower. Single point power connection shall have main disconnect and connections for external fan VFD’s and basin heaters. Single point connection shall be NEMA 3R.

M. 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: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower. Comply with 29 CFR 1910.23.
5. Internal Platforms: Aluminum, FRP, or 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

3.01 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.

3.02 INSTALLATION

A. Install cooling towers on existing supports. Provide steel beam to increase height of existing supports by 12”.

B. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.03 CONNECTIONS

A. Install piping adjacent to cooling towers to allow service and maintenance.

B. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.

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. Domestic Water Piping: Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.

F. Supply and Return Piping: Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gauge, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve. Make connections to cooling tower with a union, flange, or mechanical coupling.

G. Equalizer Piping: Piping requirements to match supply and return piping. Connect an equalizer pipe, full size of cooling tower connection, between tower cells. Connect to cooling tower with shutoff valve.

3.04 FIELD QUALITY CONTROL

A. 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.

B. Cooling towers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 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 vibration isolation and structural support.
      e. Lubricate bearings.
      f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
      g. Adjust belts to proper alignment and tension.
      h. Verify proper oil level in gear-drive housing. Fill with oil to proper level.
      i. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
      j. Check vibration switch setting. Verify operation.

k. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
l. Verify operation of basin heater and control.
m. Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
n. Replace defective and malfunctioning units.

D. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.

E. Prepare a written startup report that records the results of tests and inspections.

3.06 ADJUSTING

A. Set and balance water flow to each tower inlet.

B. Adjust water-level control for proper operating level.

3.07 DEMONSTRATION

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

END OF SECTION

SECTION 26 0500
GENERAL ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 RESPONSIBILITIES

A. The Bidding Requirements, Conditions of Contract, General Specifications and General Requirements, and this Division shall be binding on the Contractor and shall apply to all electrical work to be completed under this section.

B. The Contractor shall be responsible for the work from the date of his Contract until its acceptance by the Owner and must make good all damages sustained from whatever cause. He shall use proper care and diligence in bracing and securing all parts of the work and shall in all cases judge as to the amount of protection required.

1.03 ORDINANCES, LAWS AND CODES

A. All work shall conform to the rules and regulations of the National Electrical Code, Local Code, "Occupational Safety and Health Act" and the State Fire Marshall's Office. All certificates of approval shall be delivered to the Architect before final payment will be made.

B. Should any change in the drawings and/or specifications be required to conform to the abovementioned laws and ordinances, the Architect shall be notified by the Bidder prior to the Bid Date, that the necessary changes may be completed. After the Bid Date, all work necessary to meet the requirements shall be at Contractor's expense, with no additional cost to the Owner.

C. The Contractor shall pay all fees, permits or taxes for inspections, etc., in connection with the work under this Contract. Any costs, charges or connection fees which the Power Company assesses the Owner or Contractor in order to obtain permanent and temporary electrical service to the Project Facility will be paid by the Contractor as part of this Contract.

1.04 DATA AND MEASUREMENT

A. The data given herein and on the drawings is as exact as could be secured insofar as building construction and existing conditions are concerned. Extreme accuracy is not guaranteed. The drawings and specifications are intended for the assistance of the Contractor in achieving the end result. Exact locations, measurements, distance, levels, etc., will be governed by conditions at the Job Site.

B. The Contractor shall verify that the size of the equipment supplied by the selected manufacturers does not exceed the available mounting space.

C. The Architect reserves the right to change location or size of conduits, outlets, luminaires or other pieces of equipment as may be necessary to avoid conflicts. No extra compensation will be allowed for such changes unless additional cost to the Contractor is caused.

D. The Bidder shall visit the Project Site that he or she may have knowledge of conditions at the Job Site and adapt his work to such conditions.

1.05 DRAWINGS AND SPECIFICATIONS

A. Anything mentioned in this specification and not shown on the drawings or vice versa shall be of like effect, as shown or mentioned in both. In any case of discrepancy or differences in the figures, drawings or specifications, the Bidder shall promptly report such discrepancies to the Architect who shall make a decision in writing. Any adjustment by the Contractor without this decision shall be at the expense of the Contractor.

1.06 QUALITY OF WORKMANSHIP

A. The Contractor shall give his personal superintendence and direction to the work. He shall also keep a competent foreman or superintendent on the Project.

B. All equipment, controls and junction boxes shall be located for ready access, operation, repair or maintenance.

C. Any additional drawings necessary for the prosecution of the work will be furnished by the Architect as promptly as possible. The Contractor shall request any additional instructions needed and shall do no work without drawings and instructions.

D. Any discrepancies between the Mechanical, Electrical and Architectural Drawings shall be reported to the Architect prior to the Bid Date.

1.07 GUARANTEE

A. This Contractor shall guarantee all materials, workmanship and the successful operation of all apparatus furnished and installed by him for a period of one (1) year from the date of the final acceptance of the whole work, and shall guarantee to repair or replace at his own expense any part of the apparatus which may show defect during that time, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not to carelessness or improper operation. Guarantee period for the replacement shall begin with the date of replacement.

B. The Owner shall notify the Contractor of any failure of any part or parts which occur during the guarantee period.

C. The Contractor shall also guarantee the systems and the apparatus to be working properly to meet all conditions as specified.

1.08 SHOP DRAWINGS

A. Shop Drawings shall be submitted in accordance with the requirements of Paragraph "Shop Drawings" of the General Conditions. The Contractor shall submit Shop Drawings of all fabricated work and equipment to be purchased. Data shall be sufficiently completed to permit evaluation and comparison with specified equipment and material. Each item shall be prepared as a separate submittal, not grouped or bound with other items.

B. All drawings shall bear the Contractor’s stamp of approval and must be dated.

C. See individual specification sections for required submittals.

D. A notation shall be made on each item submitted as to its specified use or description of specific location in the work.

E. None of the preceding items shall be purchased, delivered to the site or installed until the item has been properly submitted in writing and reviewed by the Architect.

F. Submittals shall be made even though the item is exactly as specified.

G. Should the Contractor fail to comply with any of the requirements as stated, the Architect reserves the right to select a full line of materials, appliances and equipment, which shall be final and binding upon the Contractor.

1.09 SUBMITTAL DATA

A. Review of submittal data is only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for: Dimensions, which shall be confirmed and correlated at the job site; fabrication processes and

techniques of construction; coordination of his work with that of all other trades and the satisfactory performance of his work.

B. Contractor will be limited to one (1) review on a singular piece of equipment.

C. The listing of a manufacturer as "acceptable" does not imply automatic compliance with Contract Documents. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for equipment/systems, which meet or exceed the specifications included herein.

1.10 EQUAL MANUFACTURERS/EQUIPMENT

A. Any requests for manufacturer/equipment to be considered as equal other than as specified herein shall be submitted to the Engineer not less than 10 days prior to Bid Date.

B. Requests for review shall be sufficiently complete to permit evaluation and comparison with specified equipment and material.

PART 2 PRODUCTS

2.01 PROTECTION OF LUMINAIRES AND WARES

A. This Contractor shall apply the necessary protective coverage to luminaires and other equipment to prevent scratches and mars to such equipment as a result of falling objects or work of other trades.

2.02 STORAGE

A. This Contractor shall provide and be responsible for safe storage of his materials and such storage shall not interfere with the work of others or progress of the Project in any manner.

2.03 EQUIPMENT ENCLOSURES

A. Provide enclosures, which mate properly with the equipment to be enclosed and are NEMA rated to suit the atmospheric conditions of the equipment surroundings.

B. Equipment in corrosive atmosphere shall be rated NEMA 4X. All NEMA 4X equipment shall be fabricated from suitable non-metallic material or shall be stainless steel. Painted steel is not acceptable for NEMA 4X applications.

PART 3 EXECUTION

3.01 COORDINATION

A. Before installing any work, this Contractor shall coordinate the electrical work with all other Contractors on the Project, with the Electric Utility Company and the City Code enforcing department.

B. All electrical work shall be installed in proper sequence and so arranged with other trades that there will be no delay in the proper installation and completion of any part or parts of all piping systems and mechanical equipment.

C. This Contractor shall carefully examine the drawings and shall be responsible for the proper fitting of equipment and conduit as indicated without major alteration. If alterations are required, a detailed drawing of the proposed departure due to actual field conditions or other causes shall be submitted to the Architect for approval.

D. Whenever interferences might occur, before installing any of the work in question, the Electrical Contractor shall consult with other Contractors and shall come to an agreement with them as to the exact location and level of his conduit bus duct, luminaires and/or parts of his installation.

E. Where recessed electrical devices (speakers, luminaires, etc.) are installed in fire-rated ceilings, Contractor shall provide an enclosure approved by authorities having jurisdiction to surround each device as required to maintain the fire integrity rating of the ceiling. Adequate clearance between device and enclosure shall be provided in accordance with device manufacturer's

recommendations. Verify clearance requirements with device manufacturer prior to installation of luminaire.

F. Multiwire branch circuits as defined by the National Electrical Code (circuits with common neutral) shall not be used. Exception: Where an equipment manufacturer requires a multiwire branch branch circuit for only one utilization equipment and where all ungrounded conductors of that circuit are opened simultaneously by the branch circuit overcurrent device.

G. A cable raceway type wiring method, installed in exposed or concealed locations near metal-corrugated sheet roof decking, shall be installed and supported so the nearest outer surface of the cable raceway is not less than 6-inches from the nearest surface of the roof decking. Exception: Rigid metal conduit and intermediate metal conduit shall not be required to maintain this clearance.

H. All changes in the work of this Contractor, caused by his neglect to follow these instructions, shall be made at this Contractor's expense.

3.02 DITCHING, EXCAVATION AND BACKFILLING

A. Contractor shall do all excavation required to install conduits and equipment shown on drawings or required for proper operation. Excess excavation below the required level shall be backfilled with earth and thoroughly tamped.

3.03 CONNECTIONS FOR EQUIPMENT

A. Coordinate the hook up of the following equipment with the Contractor required to furnish and install them. See the appropriate sections in the General Construction Work specifications for further information.
   1. Mechanical Equipment
   2. Fire Alarm Equipment
   3. HVAC Controls Equipment
   4. Cabinetry Equipment
   5. Owner Furnished Equipment

B. Verify fuse and/or circuit breaker requirements for electrical connections to equipment and provide overcurrent devices accordingly.

C. The plans indicate the locations of system devices. The Contract shall include the wiring system required to interconnect the indicated devices to result in a complete, operating system. The interconnecting wiring shall be in conformity with the requirements of the manufacturer of the equipment as well as with other requirements set out herein. The basic wiring method to be employed is indicated herein. The Contractor's Shop Drawing submittal shall indicate the specific routing and type of wireway and the number and type of conductors to be installed.

3.04 WORK IN EXISTING BUILDING

A. Inasmuch as work under this Contract includes adding to in the existing building, it shall be the responsibility of each Bidder to fully inform himself of any and all conditions which influence or are influenced by work contemplated by these specifications and accompanying drawings. The submission of a proposal by any Bidder will be construed as an admission by him that he has examined and is fully familiar with the premises and all conditions thereon and adjacent thereto, and has included in this proposal a proper and adequate amount to cover rearrangement of old work for the proper installation and operation of the new and existing equipment as shown on the drawings specified herein or as required. Such work shall be neatly and properly done.

B. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated or when authorized otherwise in writing by Owner or Architect. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that

"cutting-over" has been successfully accomplished, remove, relocate or abandon existing wiring as indicated.

C. The operation of all special systems within the building shall be maintained, including but not limited to fire alarm, telephone, intercom, communication, data, security, emergency call, etc. Provide temporary connections/equipment as necessary for required sequence of construction. Any necessary momentary outages shall be scheduled with the Owner prior to starting such work.

3.05 DEMOLITION AND REMOVAL OF EXISTING EQUIPMENT AND MATERIALS

A. Existing conduits that are made spare by demolition work shall be removed unless concealed in existing construction.

B. All existing unused wiring shall be removed.

C. All conduits and conductors shown to be reused shall be thoroughly tested and checked for insulation breakdown and continuity.

D. Electrical items must be removed where they interfere with or are not concealed by new construction such as new ceilings, walls, etc.

E. Existing luminaires, outlets, receptacles and other equipment and material shall be relocated, removed, reconnected or left in place as indicated on the drawings. Where an existing device is shown removed from an existing circuit, new wiring shall be provided as required to insure continuity of existing circuit. If existing devices or other electrical items, such as electrically operated equipment interfere with the location of a new partition, relocation of existing equipment, new equipment, etc., the existing items including electrical components of electrically operated equipment shall be disconnected and removed or satisfactorily relocated and reconnected even though not specifically indicated on the drawings. All material removed which is considered salvageable by the Owner and is not specifically designated to be reused on the drawings or not practical to be reused shall remain in the property of the Owner and shall be neatly stockpiled in a specially designated location.

3.06 CLEANING

A. This Contractor shall at all times keep the premises free of all waste or surplus materials, rubbish and debris which is caused by his employees or resulting from his work.

B. After all equipment and luminaires have been installed and building is ready for occupancy, the Electrical Contractor shall remove all stickers, rust stains, labels, temporary covers, plaster marks, paint spots, etc. All foreign matter shall be vacuumed out of all conduits, panels, motors, devices, switches, luminaires, etc.

C. Identification plates and trims on all equipment shall be free of paint and polished.

D. The Contractor shall leave the electrical portion of the work in a safe clean and very neat condition ready for operation.

3.07 REBATES

A. The Contractor shall assist the Owner with filing of applicable forms to obtain rebates. This shall include but not be limited to determination of qualifying materials and furnishing invoices for materials with corresponding quantities.

3.08 RECORD DRAWINGS

A. The Contractor shall maintain an up-to-date set of plans and specifications on the Job Site. He shall mark all Addendum Items and any field changes on this set and see that a copy of all changes is furnished to the Architect at the end of the Project.

B. The drawings shall also include as-built conditions such as equipment locations, routing of service entrance and major feeders, etc.

3.9 INSTRUCTION IN OPERATION BOOKS AND SPARE PARTS

A. After all tests and adjustments have been made, the Contractor shall furnish the necessary qualified personnel to place the special systems in continuous operation, during which time he shall provide complete Operating and Maintenance Instructions to the Owner's representative with an outline of instructions in written form. These personnel shall reserve adequate time to instruct an Owner's representative on proper operation (including all phases of the system and each of its component parts).

B. Contractor shall furnish Owner with two (2) sets of all operating instructions, maintenance instruction and spare parts lists of all equipment furnished under this Contract. Lists shall include current unit prices and source of supply for each item of operable equipment.

3.10 FIRESTOPPING

A. Openings around electrical penetrations through fire-resistant rated walls, partitions, floors or ceilings shall be firestopped using listed materials to maintain the fire rating. Installation shall be done in accordance with manufacturer's recommendations. Materials shall be UL Listed and labeled and FM approved for fire ratings consistent with penetrated barriers.
   1. Foamed-in-place type firestopping shall only be permitted in concealed-from-view locations. Sealant type firestopping shall be used in exposed-to-view locations.
   2. Cable tray, conduit sleeves (2-inch and larger) and similar penetrations of fire-rated walls, floors or ceilings shall be sealed by a method that permits cables to be easily added or removed without damage to the firestopping materials. Products similar to Grace Construction Products Flamesafe Bags, Specified Technologies, Inc. EZ Path Fire Rated Pathway and Wiremold Flamestopper FS Series are acceptable when rated for the application. Coordinate requirements with product manufacturer and authority having jurisdiction. Foamed in place or sealant type firestopping are not acceptable at these locations.

3.11 TESTS AND ADJUSTMENTS

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

B. During the progress and after completion of the work included under this specification, the Contractor shall make all required tests at his own expense in the presence of the Architect as required hereinafter and by local ordinances, codes, laws and regulations. Such tests shall be in accordance with other sections of this division. The Architect shall be notified five (5) days in advance as to the time when such tests are to be performed that a representative of the Architect may be present.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

A. VFC: Variable frequency controller.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 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 NFPA 70.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Stranded for all feeder conductors.

B. Branch Circuits: Copper. Stranded for all branch circuit conductors. All stranded wire connections to wiring devices shall be made with compression type wire terminations. Minimum wire size shall be #12 AWG. #14 AWG wiring shall be permitted for control wiring.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway

D. Feeders Concealed in Concrete, Below Slabs-on-Grade, in Wet / Damp Locations and Underground: Type XHHW-2, single conductors in raceway.

E. Feeders Serving Emergency Systems: In addition to the requirements above feeders classified as emergency systems shall meet one of the requirements below. Emergency Systems shall be those feeders that are a part of the Life Safety Branch. Emergency systems feeders located in an enclosed ceiling space shall also conform to the conditions below. See fire protection plans and specs for areas protected by a fully automatic protection system.

1. The cable or raceway is installed in spaces or areas that are fully protected by an approved automatic fire suppression system.
2. The cable or raceway is protected by a listed electrical circuit protective system with a minimum of 2-hour rating.
3. The cable or raceway is a listed fire resistive cable system.
4. The cable or raceway is protected by a listed fire rated assembly that has a minimum rating of 2 hours and contains only emergency circuits.
5. The cable or raceway is encased in a minimum of 2 inches of concrete.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

J. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. 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.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Switch legs shall be color coded to distinguish them from Hot or Phase Conductors.

H. Switch legs occurring in the same box or enclosure shall be color coded separately.

3.04 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.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables per Section 26 0553 "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.

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly per Section 07 8413 "Penetration Firestopping."

END OF SECTION

SECTION 26 0533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers:
   1. Rigid Metallic Conduit: Allied Tube and Conduit Corporation or equivalent.
   2. Flexible Metallic Conduit: American Brass “Sealtite” or equivalent.

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. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Fittings for EMT:
      a. Material: Steel.
      b. Type: Setscrew.
   2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC or 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.

2.02 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
   1. Raco, Steel City or equivalent.

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. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:
   1. Material: Cast metal.
   2. Type: Fully adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

H. Gangable boxes are allowed.

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Fiberglass.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
      a. Mechanical rooms.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations and mechanical rooms.
   6. Damp or Wet Locations, including mechanical rooms: GRC.
   7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

B. Minimum Raceway Size: 3/4-inch (21-mm) trade size. 1/2-inch (21-mm) trade size for control wiring.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface raceways only where indicated on Drawings or where limited due to existing construction methods.

3.02 IDENTIFICATION OF BOXES

A. All junction box covers shall be labeled with the panel and circuit.

B. All concealed box covers shall be painted with enamel spray paint, using the following system:
   1. Fire Alarm - Red
   2. Emergency Power - Yellow
   3. Security and Access Controls - Orange
   4. HVAC Controls - Blue

3.03 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 (150 mm) 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 26 0529 "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 (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC before rising above floor. Where acceptable to authority having jurisdiction, rigid non-metallic conduits may be stubbed up no more than 6-inches above floor where concealed within walls.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. 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.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35 mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. 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.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) 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.

T. 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.

U. 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 or above ground raceway enters a building or structure. Include empty raceway with a removable seal.
   3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
   2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
      c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
      d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. 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.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires. Use a maximum of 24 inches at equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

Y. 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 center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. 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.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

3.04 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.05 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification for conductors.

1.03 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Room numbers must be identified with OPS room numbers and names for labeling panel directories for electrical power, intercom, fire alarm, and electronic security.

1.05 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 and standards. 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

2.01 BOXES AND RACEWAY IDENTIFICATION MATERIALS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label. Protective Overlay only required at exterior or wet locations. Provide at the following locations:
   1. Box covers labeled with panel and circuit number.

2.02 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. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

2.03 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

PART 3 EXECUTION

3.01 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. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, and handholes, 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 ungrounded service feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      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 (150 mm) 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.

B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
   1. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

END OF SECTION

PROJECT DIRECTORY:

MECHANICAL/ELECTRICAL:
BDH Engineering
440 Regency Pkwy; Suite 135
Omaha, NE 68114
402 981 5527

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

GENERAL NOTES

1. THE GENERAL CONTRACTOR SHALL VERIFY THE EXISTING/ACTUAL DIMENSIONS AND CONDITIONS SHOWN ON THE PLANS PRIOR TO COMMENCEMENT OF THE WORK. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE INSTALLATION OF NEW WORK WITHIN THESE EXISTING/ACTUAL CONDITIONS. DEVIATIONS IN THE EXISTING/ACTUAL CONDITIONS OR DIMENSIONS INDICATED SHALL BE COORDINATED WITH THE ARCHITECT AND OWNER IN ORDER TO MODIFY THE PLANS ACCORDINGLY.
2. THE DRAWINGS MAY SPECIFY DIMENSIONS, ELEVATIONS AND/OR CONSTRUCTION CONDITIONS TO BE FIELD VERIFIED. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF ALL SPECIFIED DIMENSIONS, ELEVATIONS, AND/OR CONSTRUCTION CONDITIONS PRIOR TO PROCEEDING WITH CONSTRUCTION OR FABRICATION OF ANY COMPONENTS RELATED TO SUCH CONDITIONS.
3. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONSTRUCTION MEANS AND METHODS.
4. PROVIDE ALL SPECIFIED PRODUCTS/MATERIALS UNLESS OTHERWISE NOTED OR APPROVED BY OWNER, ARCHITECT, OR ENGINEER.

INDEX OF DRAWINGS

STANDARD ABBREVIATIONS

A/C	AIR CONDITIONING
A/E	ARCHITECT/ENGINEER
ADDL	ADDITIONAL
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AFS	ABOVE FINISHED SLAB
AL	ALUMINUM
AMT	AMOUNT
ANOD	ANODIZED
ADDL	ADDITIONAL
ADDM	ADDENDUM
ADJ	ADJUSTABLE
AFF	ABOVE FINISH FLOOR
AFS	ABOVE FINISH SLAB
ALT	ALTERNATE
ARCH	ARCHITECT(URAL)
ACT	ACOUSTIC CEILING TILE
AVE	AVENUE
BFF	BELOW FINISH FLOOR
BLDG	BUILDING
B.O.	BOTTOM OF
BOT	BOTTOM
BRG	BEARING
BSMT	BASEMENT
CIP	CAST IN PLACE
CJ	CONTROL JOINT
CL	CLEAR
CLG	CEILING
CST	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CONC	CONCRETE
CONF	CONFERENCE
CONT	CONTINUOUS
COORD	COORDINATE
CPT	CARPET
CT	CERAMIC TILE
DBL	DBL
CEMO	DEMOLISH
DEPT	DEPARTMENT
DF	DRINKING FOUNTAIN
DIM	DIMENSION
DIST	DISTANCE
DS	DOWNSPOUT
DW	DISHWASHER
DWG	DRAWING
DWR	DRAWER
E	EAST
EA	EACH
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
EJ	EXPANSION JOINT
ELEC	ELECTRICAL
ELEV	ELEVATOR
EMER	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EPS	EXPANDED POLYSTYRENE
EQ	EQUAL
EXT	EXTERIOR
FE	FIRE EXTINGUISHER
FF&E	FIXTURES FURNITURE & EQUIPMENT
FFE	FINISH FLOOR ELEVATION
FLG	FLANGE/FLASHING/FLOORING
FLR	FLOOR
FPRG	FIREPROOFING
FT	FT
FTG	FOOTING
FUT	FUTURE
FV	FIELD VERIFY
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GPL	GYPSUM PLASTER
GWB	GYPSUM WALL BOARD
HC	HOLLOW CORE
HD	HARDBOARD
HDBD	HARDWOOD
HDWR	HARDWARE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HGT	HEIGHT
HVAC	HEATING, VENTILATION, & AIR CONDITIONING
INSUL	INSULATION
INT	INTERIOR
JAN	JANITOR
KIT	KITCHEN
LAB	LABORATORY
LAV	LAVATORY
LVL	LEVEL
LW	LIGHTWEIGHT
M/R	MOISTURE RESISTANT
MAINT	MAINTENANCE
MAT'L	MATERIAL
MAX	MAXIMUM
MDF	MEDIUM DENSITY FIBERBOARD
MECH	MECHANICAL
MEZZ	MEZZANINE
MFG	MANUFACTURING
MFR	MANUFACTURER
MISC	MISCELLANEOUS
MULT	MULTIPLE
N	NORTH
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE
OFCI	OWNER FURNISHED/ CONTRACTOR INSTALLED
OFF	OFFICE
OFOI	OWNER FURNISHED/ OWNER INSTALLED
OH	OVERHEAD
OPP	OPPOSITE
OPT	OPTIONAL
ORIG	ORIGINAL
P	PAINT
PLAM	PLASTIC LAMINATE
PLY	PLYWOOD
POLY	POLYSTYRENE
POLYISO	POLYISOCYANURATE
PR	PAIR
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
RE:	REFERENCE
REQ'D	REQUIRED
REV	REVERSE/REVISION
RO	ROUGH OPENING
S	SOUTH/STAIN
SC	SOLID CORE
SCHED	SCHEDULE
SCWD	SOLID CORE WOOD
SF	SQUARE FEET
SGL	SINGLE
SIM	SIMILAR
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
ST	STREET
STD	STANDARD
STOR	STORAGE
STRUCT	STRUCTURAL
SUSP	SUSPENDED
T&B	TOP & BOTTOM
T&G	TONGUE & GROOVE
TBD	TO BE DETERMINED
TEMP	TEMPORARY
THRU	THROUGH
TLT	TOILET/TOILET ROOM
T.O.	TOP OF
TYP	TYPICAL
UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VEST	VESTIBULE
W	WEST
W/	WITH
W/O	WITHOUT
W/R	WATER RESISTANT
WC	WATER CLOSET
WHSE	WAREHOUSE
WMT	WALK-OFF MAT

Omaha North High
MAGNET SCHOOL

BID NUMBER 26-004

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I, Brian Howel, am the Coordinating Professional on the OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT project.

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

COVER SHEET

BDH ENGINEERING
BDH Engineering
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PROFESSIONAL ENGINEER BRIAN L. HOWELL E-15785 STATE OF NEBRASKA

7/16/2025

PROJECT: 25023

DATE: 07/16/2025

SHEET G0.0

PLUMBING AND MECHANICAL SYMBOLS LEGEND

(AS APPLICABLE)

PIPING AND SPECIALTIES

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
RD	REFRIGERANT DISCHARGE	PGR	PROPYLENE GLYCOL RETURN		INLINE PUMP
RL	REFRIGERANT LIQUID	PGS	PROPYLENE GLYCOL SUPPLY	MV	AIR VENT - MANUAL
RS	REFRIGERANT SUCTION	FOR	FUEL OIL RETURN	A	AIR VENT - AUTOMATIC
CD	COIL CONDENSATE DRAIN	FOS	FUEL OIL SUPPLY	FS	FLOW SWITCH
LPS (XX)	LOW PRESSURE STEAM (PRESSURE)	FOV	FUEL OIL VENT	PS	PRESSURE SWITCH
MPS (XX)	MEDIUM PRESSURE STEAM (PRESSURE)	CR	CONDENSER WATER RETURN	AS-	AIR SEPARATOR
HPS (XX)	HIGH PRESSURE STEAM (PRESSURE)	CS	CONDENSER WATER SUPPLY	D / R	THERMOMETER
LPC	LOW PRESSURE CONDENSATE	HPWR	HEAT PUMP WATER RETURN	TW	THERMOMETER WELL
MPC	MEDIUM PRESSURE CONDENSATE	HPWS	HEAT PUMP WATER SUPPLY		BALL JOINT
HPC	HIGH PRESSURE CONDENSATE	D / R	PITCH OF PIPE, RISE (R) OR DROP (D)	PSD	PUMP SUCTION DIFFUSER
PC	PUMPED CONDENSATE		PIPE ANCHOR - MAIN		FLOAT THERMOSTATIC TRAP
MU	MAKE-UP WATER		PIPE ANCHOR - INTERMEDIATE		FLOWMETER - ORIFICE
HCR	HOT/CHILLED WATER RETURN	H	HANGER - ROD		FLOWMETER - VENTURI
HCS	HOT/CHILLED WATER SUPPLY	H	HANGER - SPRING		DUPLEX STRAINER
HWR	HEATING WATER RETURN		ALIGNMENT GUIDE		
HWS	HEATING WATER SUPPLY		FLEX CONNECTOR		
CWR	CHILLED WATER RETURN		EXPANSION - LOOP		
CWS	CHILLED WATER SUPPLY		EXPANSION - JOINT		
EGR	ETHYLENE GLYCOL RETURN				
EGS	ETHYLENE GLYCOL SUPPLY				

DUCTWORK

RECT. RND. OVAL			
	SUPPLY (SA), OUTSIDE (OA), VENTILATION (VA) AIR DUCT (UP/DOWN/SECTION)	R	ELEVATION CHANGE (RISE OR DROP)
	RETURN (RA) AIR DUCT (UP/DOWN/SECTION)		HIGH EFF. TAKE OFF FITTING WITH VOLUME DAMPER
	EXHAUST (EA) AIR DUCT (UP/DOWN/SECTION)	BD	BACKDRAFT DAMPER
10/6 SA	RECTANGLE DUCT (WIDTH/HEIGHT/SYSTEM)		TURNING VANES
10 Ø SA	ROUND DUCT (DIAMETER/SYSTEM)	VD	VOLUME CONTROL DAMPER
10/6 Ø SA	FLAT OVAL DUCT (WIDTH/HEIGHT/SYSTEM)		VOLUME CONTROL DAMPER
	FLEXIBLE DUCTWORK		OPPOSED BLADE DAMPER
			PARALLEL BLADE DAMPER

FD	FIRE DAMPER (IN HORIZONTAL DUCT)		
SD	SMOKE DAMPER (IN HORIZONTAL DUCT)		
FD	FIRE DAMPER (IN VERTICAL DUCT)		
SD	SMOKE DAMPER (IN VERTICAL DUCT)		
FSD	FIRE/SMOKE DAMPER (IN HORIZONTAL DUCT)		
FSD	FIRE/SMOKE DAMPER (IN VERTICAL DUCT)		
AD	DUCT ACCESS PANEL		
RP	RELIEF PANEL		
CAP	DUCT END CAP		

H.V.A.C.

	SUPPLY DIFFUSER		VAV TERMINAL UNIT
	SUPPLY REGISTER		FAN POWERED VAV TERMINAL UNIT
	SUPPLY SLOT DIFFUSER		SIDE WALL DIFFUSER
	RETURN REGISTER		ROUND DIFFUSER
	RETURN GRILLE		EXTERIOR LOUVER
	EXHAUST REGISTER	X / CFM	SUPPLY IDENTIFICATION TAG X DENOTES TYPE
	EXHAUST GRILLE	X / CFM	RETURN/ EXHAUST/LOUVER IDENTIFICATION TAG X DENOTES TYPE
	DUAL DUCT TERMINAL UNIT	M	MOTORIZED ACTUATOR
			PNEUMATIC ACTUATOR

T	THERMOSTAT		
T_G	THERMOSTAT WITH GUARD		
S_{XX-X}	TEMPERATURE SENSOR - XX-X DENOTES SERVED		
S_{CO}	CARBON MONOXIDE SENSOR		
S_{CO2}	CARBON DIOXIDE SENSOR		
S_{NOX}	NITROGEN DIOXIDE SENSOR		
S_H	HUMIDITY SENSOR		
S_P	PRESSURE SENSOR		
S_G	TEMPERATURE SENSOR WITH GUARD		
H	HUMIDISTAT		
	EMERGENCY SHUTDOWN SWITCH		

FITTINGS

SINGLE LINE	DOUBLE LINE		SINGLE LINE	DOUBLE LINE		SINGLE LINE	DOUBLE LINE	
		ELBOW			ELBOW - DOUBLE BRANCH			REDUCER - CONCENTRIC
		LONG RADIUS ELBOW			ELBOW - SIDE OUTLET UP			REDUCER - ECCENTRIC
SR	SR	SHORT RADIUS ELBOW			ELBOW - SIDE OUTLET DOWN			CAPPED CONNECTION
		45° ELBOW			ELBOW - OUTLET DOWN			THREADED CONNECTION
		TEE			ELBOW - OUTLET UP			FLANGED CONNECTION
		CROSS			TEE - OUTLET DOWN			STRAINER
		LATERAL			TEE - OUTLET UP			STRAINER WITH BALL VALVE DRAIN
		TEE - SINGLE SWEEP			TEE - SIDE OUTLET DOWN			STRAINER WITH COUPLER
					TEE - SIDE OUTLET UP			BUSHING
					SIAMESE CONNECTION			FLOW DIRECTION

VALVES

	GATE VALVE		STOP/CHECK GATE VALVE (ARROW IND. FLOW)
	ANGLE GATE VALVE	S	SPRING GATE CHECK VALVE (ARROW IND. FLOW)
	BALL VALVE		SWING GATE CHECK VALVE (ARROW IND. FLOW)
L	LOCKABLE BALL VALVE		ANGLE STOP/CHECK VALVE
	BUTTERFLY VALVE	M	2-WAY ELECTROMOTOR VALVE
	GLOBE VALVE	P	2-WAY AIRMOTOR VALVE
	ANGLE GLOBE VALVE		2-WAY MANUAL VALVE
	PLUG VALVE	M	3-WAY ELECTROMOTOR VALVE
	DIAPHRAGM VALVE	P	3-WAY AIRMOTOR VALVE
	DIAPHRAGM ACTUATED VALVE		3-WAY MANUAL VALVE
	VALVE IN VERTICAL LINE		SAFETY PRESSURE RELIEF VALVE
	HOSE GATE VALVE		PRESSURE RELIEF VALVE
	HOSE GLOBE VALVE		TEMPERATURE MIXING VALVE
	HOSE ANGLE VALVE		AUTO FLOW VALVE
S	SOLENOID VALVE		FLOAT VALVE
PIV	POST INDICATOR VALVE		LOCK SHIELD
			CIRCUIT SETTER

	MULTIPURPOSE VALVE		
PRV-X	PRESSURE REDUCING VALVE		
PRV-X	PRESSURE REDUCING PILOT VALVE		
BPH	REDUCED PRESS. BACKFLOW ASSY.		
DC	DOUBLE CHK VALVE BACKFLOW ASSY.		
DDC	DOUBLE DETECTOR CHECK VALVE		
	OUTSIDE STEM & YOKE VALVE		
	QUICK CLOSING FUSIBLE LINK VALVE		
	QUICK OPENING VALVE		
	PRESSURE GAUGE & BALL VALVE		
	GATE VALVE WITH GLOBE VALVE BY-PASS		
	GLOBE VALVE WITH GLOBE VALVE BY-PASS		
	SPRINKLER - CONCEALED		
R	SPRINKLER - RECESSED		
	SPRINKLER - SIDEWALL		
	SPRINKLER - UPRIGHT		
	SPRINKLER - ZONE CONTROL		

MEDICAL PIPING

MA	MEDICAL AIR	N	MEDICAL NITROGEN	VAC	MEDICAL VACUUM
NOX	MEDICAL NITROUS OXIDE	OX	MEDICAL OXYGEN	WAG	WASTE ANESTHETIC GAS DISPOSAL

PLUMBING

	PIPE REMOVAL	NPCW	NON-POTABLE COLD WATER	P	TRAP PRIMER
DCW	DOMESTIC COLD WATER	NPHW	NON-POTABLE HOT WATER	HB	HOSE BIBB
DHW	DOMESTIC HOT WATER	NPSW	NON-POTABLE SOFT WATER	WH	WALL HYDRANT
RHW	DOMESTIC HOT WATER RECIRC.	PD	PUMPED DISCHARGE	RH	ROOF HYDRANT
DSW	DOMESTIC SOFT WATER	G (XX)	NATURAL GAS (PSIG)	CO	CLEAN OUT
SAN	SANITARY	PG (XX)	PROPANE GAS (PSIG)	FCO	FLOOR CLEAN OUT
ST	STORM	V	VENT	FD	FLOOR DRAIN
SO	STORM OVERFLOW	AW	ACID WASTE	VTR	VENT THRU ROOF (X DENOTES IDENTIFICATION)
GW	GREASE WASTE	AV	ACID VENT	RD	ROOF DRAIN
CA	COMPRESSED AIR	OSW	OIL/SAND	ORD	OVERFLOW ROOF DRAIN
PA	PROCESSED AIR	IR	IRRIGATION	DSN	DOWNSPOUT NOZZLE

MISCELLANEOUS

XX / X	EQUIPMENT IDENTIFICATION TAG (ELECTRICAL CONNECTION REQUIRED)		NEW CONNECTION POINT	WC	WATER CLOSET
X / XX	DETAIL REFERENCE SHEET REFERENCE		POINT OF DISCONNECT	UR	URINAL
		OA	OUTSIDE AIR	L	LAVATORY
X / XX — X / XX	SECTION CUT REFERENCE SHEET REFERENCE	VA	VENTILATION AIR	S	SINK
		EA	EXHAUST AIR	DF	DRINKING FOUNTAIN
	ELECTRICAL PANEL - SHOWN FOR COORDINATION PURPOSES ONLY	RA	RELIEF OR RETURN AIR	EWC	ELECTRIC WATER COOLER
		SA	SUPPLY AIR	SS	SERVICE SINK
	ELECTRICAL PANEL - SHOWN FOR COORDINATION PURPOSES ONLY	MA	MIXED AIR	SH	SHOWER
		RF	RELIEF OR RETURN FAN	DWH	DOMESTIC WATER HEATER
	ELECTRICAL PANEL - SHOWN FOR COORDINATION PURPOSES ONLY	EF	EXHAUST FAN	MSB	MOP SINK BASIN
		DCE	DUST COLLECTION EXHAUST		DASHED DARK LINEWORK = DEMOLITION
T	ELECTRICAL TRANSFORMER - SHOWN FOR COORDINATION PURPOSES ONLY	(TYP)	TYPICAL	(E)	LIGHT LINEWORK = EXISTING
					DARK LINEWORK = NEW

GENERAL MECHANICAL / PLUMBING DEMOLITION NOTES

APPLY TO ALL MECHANICAL AND PLUMBING SHEETS

1. ALL EXISTING ITEMS AND ASSOCIATED PIPING, ACCESSORIES, SUPPORTS AND HANGERS INDICATED BY BOLD, DASHED, HEAVY LINES OR IDENTIFIED BY NOTES, SHALL BE COMPLETELY REMOVED. PRIOR TO PROPER DISPOSAL OF REMOVED ITEMS, OWNER SHALL HAVE FIRST RIGHT OF REFUSAL.
2. DRAWINGS INDICATE APPROXIMATE ROUTING OF PIPING, DUCTWORK AND MAJOR COMPONENTS AND DO NOT INCLUDE ALL OFFSETS, FITTINGS, VALVES, ETC. CONTRACTOR SHALL FIELD VERIFY EXACT SIZE AND ROUTING PRIOR TO REMOVAL OR RELOCATION. CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR REMOVAL OF MISCELLANEOUS MECHANICAL ITEMS LOCATED ON OR IN ANY WALLS TO BE REMOVED.
3. EXISTING INSULATION DAMAGED DURING DEMOLITION / CONSTRUCTION ACTIVITIES SHALL BE REPAIRED WITH SIMILAR MATERIALS.
4. ALL OPENINGS THROUGH WALLS AND FLOOR SLABS NOT BEING REUSED SHALL BE PATCHED WITH LIKE MATERIALS AND PAINTED TO MATCH EXISTING.
5. ALL OPENINGS THROUGH ROOF NOT BEING REUSED SHALL BE PATCHED WITH LIKE MATERIALS AND SEALED WATERTIGHT.
6. CONTRACTOR SHALL REMOVE ALL MATERIALS AS REQUIRED AND SHALL GIVE OWNER THE OPPORTUNITY TO INSPECT SUCH MATERIALS FOR POTENTIAL SALVAGE. CONTRACTOR SHALL REMOVE FROM THE SITE ALL MATERIALS DEEMED "NON-SALVAGEABLE" BY THE OWNER. CONTRACTOR SHALL TURN OVER TO OWNER ALL MATERIALS DEEMED "SALVAGEABLE" BY THE OWNER.

GENERAL MECHANICAL NOTES

APPLY TO ALL MECHANICAL SHEETS

A. LIGHT LINE WEIGHT INDICATES EXISTING ITEMS AND ASSOCIATED MATERIALS TO REMAIN. BOLD LINE WEIGHT INDICATES NEW WORK TO BE INSTALLED UNDER THIS CONTRACT.
B. ROUTING INDICATED ON DRAWINGS IS APPROXIMATE AND DOES NOT INCLUDE ALL OFFSETS, FITTINGS, VALVES, ETC. CONTRACTOR TO FIELD VERIFY DUCT SIZE AND SERVICE PRIOR TO FINAL CONNECTION. COORDINATE LOCATION OF HVAC WORK WITH LIGHTING, STRUCTURAL MEMBERS, PIPING SYSTEMS, ETC. PROVIDE OFFSETS AND CLEARANCES OR RELOCATE HVAC WORK AS REQUIRED TO AVOID CONFLICTS WITH WORK OF ALL OTHER TRADES.
C. HVAC WORK SHALL NOT BE LOCATED OVER ELECTRICAL, DATA, OR COMMUNICATION EQUIPMENT ROOMS. HVAC WORK SHALL NOT BE LOCATED ABOVE ELECTRICAL / DATA / COMMUNICATION EQUIPMENT OR PANELS.
D. SUPPORT ALL DUCTWORK, PIPING, EQUIPMENT, ETC. FROM BUILDING STRUCTURE. HOLD PIPING TIGHT TO BOTTOM OF STRUCTURAL MEMBERS OR RUN THROUGH JOIST WEBS IF POSSIBLE. DO NOT USE WIRE OR PERFORATED METAL TO SUPPORT PIPING. DO NOT SUPPORT PIPING FROM OTHER PIPING, DUCTWORK AND/OR ELECTRICAL CONDUITS. DO NOT SUPPORT FROM BOTTOM OF CHORD OF BAR JOIST OR FROM METAL ROOF DECK.
E. ALL DUCT SIZES SHOWN ARE CLEAR AIRWAY DIMENSIONS. INCREASE SHEET METAL SIZE TO ACCOMMODATE DUCT LINER AS REQUIRED.
F. ELBOWS SHALL BE CONSTRUCTED WITH CENTERLINE RADIUS OF NOT LESS THAN 1-1/2 TIMES THE WIDTH OF DUCT. WHERE SPACE CONDITIONS DO NOT PERMIT THIS RADIUS OR WHERE INDICATED ON DRAWINGS SQUARE ELBOWS WITH TURNING VANES SHALL BE USED.
G. SIZE TRANSITIONS WITH A MINIMUM SLOPE OF 1:4.
H. PROVIDE DRAW BANDS AND SEAL END OF DUCT INSULATION ON ALL FLEXIBLE CONNECTIONS. MAXIMUM LENGTH OF FLEXIBLE DUCTS SHALL BE THREE FEET.
I. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY SEALING PENETRATIONS THROUGH A FIRE RATED, SMOKE RATED OR COMBINATION FIRE & SMOKE RATED SEPARATIONS. SEE SPECIFICATIONS FOR FIRE & SMOKE RATED SEALANTS. SEE ARCHITECTURAL PLANS FOR RATED SEPARATIONS.
J. COORDINATE ALL GRILLE, REGISTER AND DIFFUSER LOCATIONS WITH REFLECTED CEILING PLAN, LIGHT FIXTURES, SPRINKLER HEADS, COMMUNICATION/SOUND DEVICES AND FIRE ALARM DEVICES.
K. INSTALL ESCUTCHEON PLATES ON ALL WALL PENETRATIONS SERVING ROUND DUCT WALL PENETRATIONS. FABRICATE ESCUTCHEON PLATES TO TRIM THE OPENING IN THE WALL.
L. INSTALL WALL ANGLE FOR ALL RECTANGULAR DUCT PENETRATIONS THROUGH WALLS.
M. FOR EXPOSED DUCTWORK THOROUGHLY CLEAN, REMOVE ALL SHIPPING LABELS AND OTHER IDENTIFICATION TAGS. DUCTWORK DESIGNATED TO BE PAINTED SHALL HAVE PHOSPHATIZED FINISH. PROVIDE MILL-PHOSPHATIZED FINISH FOR EXPOSED NOT DESIGNATED TO BE PAINTED. COORDINATE WITH ARCHITECTURAL DRAWINGS DUCTWORK DESIGNATED FOR PAINTING AND EXPOSED DUCTWORK REQUIREMENTS.
N. PROVIDE DUCT MOUNTED ACCESS DOOR AT FIRE DAMPER, SMOKE DAMPER OR COMBINATION FIRE/SMOKE DAMPERS TO ALLOW FOR MAINTENANCE AND VISUAL INSPECTION PER NFPA REQUIREMENTS.
O. VOLUME DAMPERS ABOVE INACCESSIBLE CEILINGS SHALL HAVE EXTENSION RODS AND ESCUTCHEON PLATES.
P. LOCATE AND INSTALL EQUIPMENT TO PROVIDE ALL CODE AND MANUFACTURER'S RECOMMENDED CLEARANCES. KEEP HVAC PIPING, DUCTWORK, ETC. OUT OF CLEARANCE AREAS.
Q. ALL OPENINGS IN WALLS AND FLOORS FOR PIPING SHALL BE CORE DRILLED OR SAW CUT, UNLESS OTHERWISE NOTED.
R. ALL HVAC PIPING WORK SHALL BE LOCATED ABOVE CEILINGS, IN A PIPE CHASE, OR OTHER CONCEALED LOCATIONS, UNLESS OTHERWISE NOTED. LOCATE AND ARRANGE VALVES, DRAIN FITTINGS, ETC. TO BE ACCESSIBLE THROUGH LAY-IN CEILINGS, ACCESS PANELS OR ACCESS DOORS. PROVIDE ACCESS PANEL OR ACCESS DOOR FOR ALL VALVES, DRAIN FITTINGS, ETC. AT NON-ACCESSIBLE LOCATIONS.
S. INSTALL SECTIONAL VALVES ON EACH BRANCH AND/OR RISER SERVING TWO OR MORE HYDRONIC TERMINALS OR EQUIPMENT CONNECTIONS. INSTALL VALVES ADJACENT TO MAIN.
T. INSTALL SHUTOFF VALVES ON INLET AND OUTLET OF EACH MECHANICAL EQUIPMENT ITEM AND/OR EACH HYDRONIC TERMINAL.
U. SLOPE HVAC PIPING TO DRAIN VALVES. PROVIDE MANUAL AIR VENTS AT HIGH POINTS AND AT TOP OF RISERS.
V. SEAL ALL HVAC PENETRATIONS. SEAL PENETRATIONS THROUGH RATED WALLS, FLOORS OR CEILINGS WITH MATERIALS APPROPRIATE FOR RATING.
W. PIPING IN EXTERIOR WALLS SHALL BE LOCATED ON THE INTERIOR SIDE OF BUILDING INSULATION AND VAPOR BARRIER.
X. COORDINATE INSTALLATION OF BUILDING INSULATION TO RUN CONTINUOUS BETWEEN PIPING AND EXTERIOR WALL SURFACE.
Y. PVC PIPING SHALL NOT BE INSTALLED IN ANY RETURN AIR PLENUM UNLESS THE PIPING IS INSTALLED IN A PRE-APPROVED RATED ASSEMBLY.
Z. COORDINATE DUCTWORK WITH STRUCTURAL CROSS BRACING. PROVIDE TOP AND BOTTOM BRIDGING BETWEEN JOISTS WHERE DUCTWORK IS TO BE INSTALLED BETWEEN THE JOISTS. COORDINATE WITH ALL TRADES.

GENERAL PLUMBING NOTES

APPLY TO ALL PLUMBING SHEETS

A. LIGHT LINE WEIGHT INDICATES EXISTING ITEMS AND ASSOCIATED MATERIALS TO REMAIN. BOLD LINE WEIGHT INDICATES NEW WORK TO BE INSTALLED UNDER THIS CONTRACT.
B. ROUTING INDICATED ON DRAWINGS IS APPROXIMATE AND DOES NOT INCLUDE ALL OFFSETS, FITTINGS, VALVES, ETC. CONTRACTOR TO FIELD VERIFY PIPE SIZE AND SERVICE PRIOR TO FINAL CONNECTION. COORDINATE LOCATION OF PLUMBING PIPING WORK WITH LIGHTING, STRUCTURAL MEMBERS, HVAC, PIPING SYSTEMS, ETC. PROVIDE OFFSETS AND CLEARANCES OR RELOCATE PLUMBING WORK AS REQUIRED TO AVOID CONFLICTS WITH WORK OF ALL OTHER TRADES.
C. PLUMBING WORK SHALL NOT BE LOCATED OVER ELECTRICAL, DATA OR COMMUNICATION EQUIPMENT ROOMS. PLUMBING WORK SHALL NOT BE LOCATED ABOVE ELECTRICAL / DATA / COMMUNICATION EQUIPMENT OR PANELS.
D. SUPPORT ALL PLUMBING PIPING, EQUIPMENT, ETC. FROM BUILDING STRUCTURE. HOLD PIPING TIGHT TO BOTTOM OF STRUCTURAL MEMBERS OR RUN THROUGH JOIST WEBS IF POSSIBLE. DO NOT USE WIRE OR PERFORATED METAL TO SUPPORT PIPING. DO NOT SUPPORT PIPING FROM OTHER PIPING, DUCTWORK AND/OR ELECTRICAL CONDUITS. DO NOT SUPPORT FROM BOTTOM OF CHORD OF BAR JOIST OR FROM METAL ROOF DECK.
E. ROUTE ABOVE GRADE DRAINAGE PIPING AS HIGH AS POSSIBLE AND COORDINATE WITH OTHER TRADES.
F. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY SEALING PENETRATIONS THROUGH A FIRE RATED, SMOKE RATED OR COMBINATION FIRE & SMOKE RATED SEPARATIONS. SEE SPECIFICATIONS FOR FIRE & SMOKE RATED SEALANTS. SEE ARCHITECTURAL PLANS FOR RATED SEPARATIONS.
G. INSTALL ESCUTCHEON PLATES ON ALL WALL AND FLOOR PENETRATIONS SERVING EXPOSED PLUMBING PIPING WALL PENETRATIONS.
H. ALL OPENINGS IN WALLS AND FLOORS FOR PIPING SHALL BE CORE DRILLED OR SAW CUT, UNLESS OTHERWISE NOTED.
I. LOCATE AND INSTALL EQUIPMENT TO PROVIDE ALL CODE AND MANUFACTURER'S RECOMMENDED CLEARANCES. KEEP HVAC PIPING, DUCTWORK, ETC. OUT OF CLEARANCE AREAS.
J. ALL PLUMBING PIPING WORK SHALL BE LOCATED ABOVE CEILINGS, IN A PIPE CHASE, OR OTHER CONCEALED LOCATIONS, UNLESS OTHERWISE NOTED. LOCATE AND ARRANGE VALVES, DRAIN FITTINGS, ETC. TO BE ACCESSIBLE THROUGH LAY-IN CEILINGS, ACCESS PANELS OR ACCESS DOORS. PROVIDE ACCESS PANEL OR ACCESS DOOR FOR ALL VALVES, DRAIN FITTINGS, ETC. AT NON-ACCESSIBLE LOCATIONS.
K. INSTALL SECTIONAL VALVES ON EACH BRANCH AND/OR RISER SERVING TWO OR MORE PLUMBING FIXTURES OR EQUIPMENT CONNECTIONS. INSTALL VALVES ADJACENT TO MAIN.
L. INSTALL SHUTOFF VALVES ON INLET AND OUTLET OF PLUMBING EQUIPMENT.
M. INSTALL STOPS AT EACH PLUMBING FIXTURE EXCEPT AT FLUSHOMETER LOCATIONS.
N. SEAL ALL PLUMBING PIPING PENETRATIONS. SEAL PENETRATIONS THROUGH RATED WALLS, FLOORS OR CEILINGS WITH MATERIALS APPROPRIATE FOR RATING.
O. PIPING IN EXTERIOR WALLS SHALL BE LOCATED ON THE INTERIOR SIDE OF BUILDING INSULATION AND VAPOR BARRIER.
P. COORDINATE INSTALLATION OF BUILDING INSULATION TO RUN CONTINUOUS BETWEEN PIPING AND EXTERIOR WALL SURFACE.
Q. COORDINATE EXACT LOCATION OF FLOOR DRAINS AND FLOOR SINKS. TOP OF GRATE SHALL BE 1/8" BELOW FINISHED FLOOR ELEVATION.
R. COMPLY WITH LOCAL UTILITY COMPANY RULES AND REGULATIONS FOR ALL GAS METER INSTALLATIONS. COORDINATE EXACT LOCATION OF GAS CONNECTIONS WITH EQUIPMENT SUPPLIED.
S. COPPER PIPING LOCATED ABOVE GRADE SHALL BE TYPE "L"; COPPER PIPING LOCATED BELOW GRADE SHALL BE TYPE "K" AND RUN CONTINUOUS WITHOUT JOINTS BELOW GRADE. TYPE "M" COPPER SHALL NOT BE USED ON PRESSURIZED PIPING SYSTEMS.
T. DRAINAGE PIPING 3 INCHES AND SMALLER SHALL SLOPE NO LESS THAN 1/4 INCH PER FOOT. DRAINAGE PIPING 4 INCHES AND LARGER SHALL SLOPE NO LESS THAN 1/8 INCH PER FOOT.
U. INSTALL WALL CLEAN OUTS (WCO) WHEN LOCATED BEHIND A WATER CLOSET AT 30" A.F.F. OR AT 42" A.F.F. ABOVE CABINETRY ON ALL SANITARY & STORM STACKS.
V. COORDINATE EXACT STORM PIPE CONNECTIONS WITH STORM DRAIN LOCATIONS SHOWN ON ARCHITECTURAL ROOF PLAN.
W. INSTALL VENT-THRU-ROOF (VTR) A MINIMUM OF 10'-0" AWAY FROM ANY OUTSIDE AIR INTAKE.
X. REMOVE, REPAIR AND REPLACE WALLS, FLOORS, ROOFS AND CEILINGS TO MATCH EXISTING, WHERE NECESSARY FOR PIPING AND FIXTURE REMOVAL & INSTALLATION.
Y. KITCHEN EQUIPMENT FURNISHED BY KITCHEN EQUIPMENT CONTRACTOR - PLUMBING CONTRACTOR SHALL ROUGH-IN AND MAKE FINAL CONNECTIONS TO UTILITIES REQUIRED AND PROVIDE PIPING, STOPS, WATER HAMMER ARRESTERS, TRAPS AND FITTINGS FOR EQUIPMENT TO BE IN OPERATIONAL ORDER. COORDINATE WITH KITCHEN EQUIPMENT SUPPLIER FOR CONNECTIONS AND LOCATIONS. SEE KITCHEN EQUIPMENT CONNECTION SCHEDULE FOR RESPONSIBILITY OF WHO FURNISHES VACUUM BREAKERS AND PRESSURE REDUCING VALVES.
Z. PVC PIPING SHALL NOT BE INSTALLED IN ANY RETURN AIR PLENUM UNLESS THE PIPING IS INSTALLED IN A PRE-APPROVED RATED ASSEMBLY.
AA. PROVIDE ACCESSIBLE SHUTOFF VALVE INSIDE THE BUILDING FOR EACH WALL HYDRANT.
BB. CONTRACTOR SHALL COORDINATE ALL CONNECTIONS OF PLUMBING SYSTEMS WITH EXTERIOR SITE UTILITIES AND SERVICES PRIOR TO INSTALLING ANY PIPING ON THE INTERIOR. CONTRACTOR SHALL CONFIRM THAT ALL INTERIOR PIPE INVERTS AND PIPE INVERTS AT THE 5' LINE MATCH EXTERIOR PIPE INVERTS, PRIOR TO INSTALLING ANY INTERIOR PIPING BELOW FLOOR.

NOTICE:
DO NOT SCALE DRAWINGS. VERIFY ALL DIMENSIONS AND CLEARANCES FROM ARCHITECTURAL, STRUCTURAL, SHOP AND OTHER APPROPRIATE DRAWINGS OR AT SITE. LAY OUT AND COORDINATE ALL WORK PRIOR TO INSTALLATION TO PROVIDE CLEARANCES REQUIRED FOR OPERATION, MAINTENANCE, AND CODES. VERIFY NON-INTERFERENCE WITH OTHER WORK. DO NOT FABRICATE PRIOR TO VERIFICATION OF CLEARANCES FOR ALL TRADES. THIS NOTICE APPLIES TO ALL MECHANICAL / PLUMBING PLANS.

MECHANICAL

Sheet Number	Sheet Name
MECHANICAL	
M0.0	MECHANICAL SYMBOLS LEGEND AND GENERAL NOTES
M0.1	NORTH MECHANICAL KEY PLAN
M0.2	NORTHWEST MECHANICAL KEY PLAN
M0.3	NORTH MECHANICAL DEMOLITION PLAN
M0.4	NORTHWEST MECHANICAL DEMOLITION PLAN
M1.1	NORTH MECHANICAL PLAN
M1.2	NORTHWEST MECHANICAL PLAN
M7.1	MECHANICAL DETAILS AND SCHEDULES
Grand total: 8	

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

MECHANICAL SYMBOLS LEGEND AND GENERAL NOTES

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PROFESSIONAL MECHANICAL ENGINEER — BRIAN D. HOWELL E-15785 — STATE OF NEBRASKA

7/16/2025

PROJECT: 25023
DATE: 07/16/2025
SHEET M0.0

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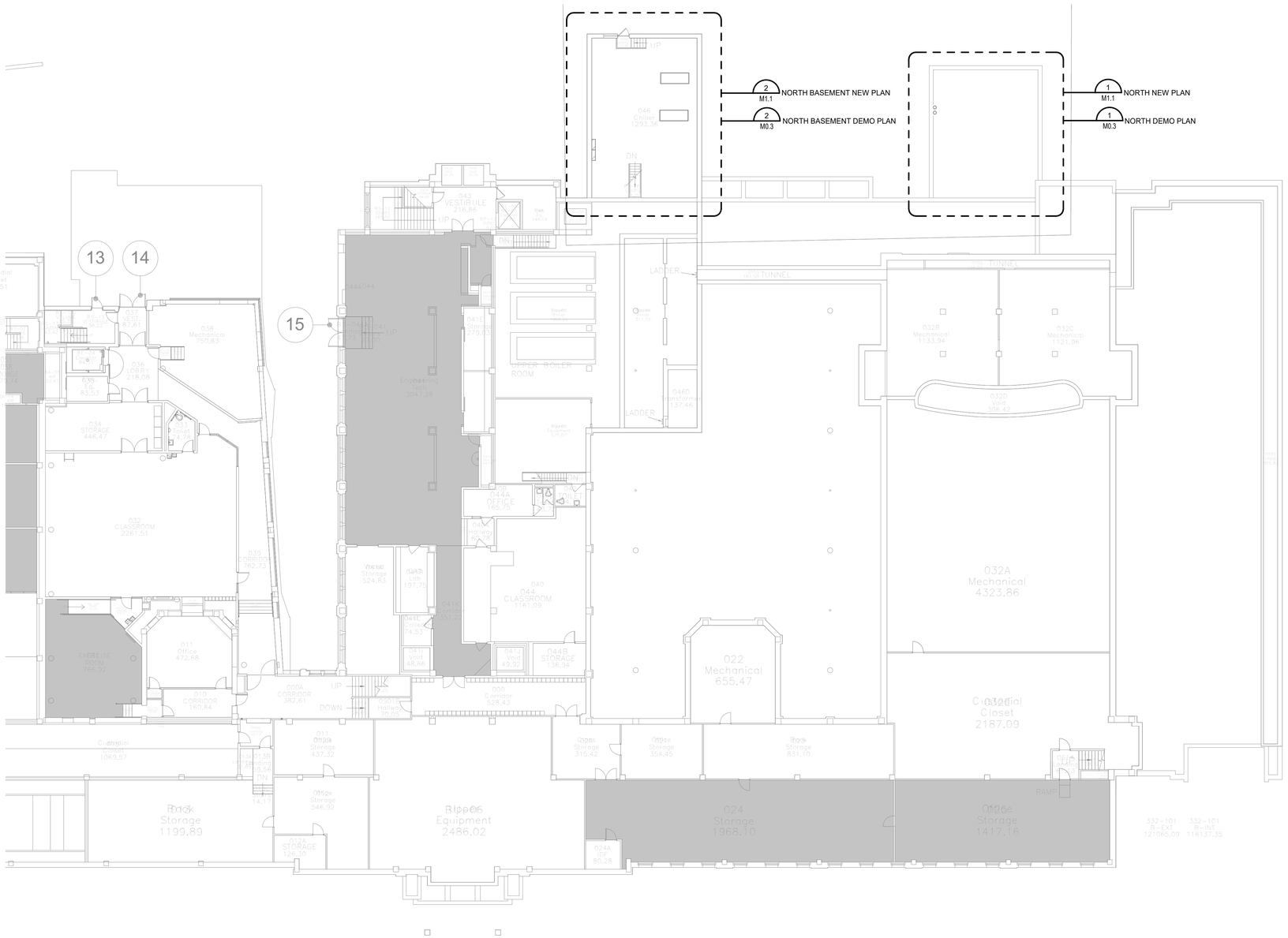

NORTH MECHANICAL KEY PLAN

SCALE: 1/16" = 1'-0"

0' 4' 8' 16' 32' 48'

NORTH

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

NORTH MECHANICAL KEY PLAN

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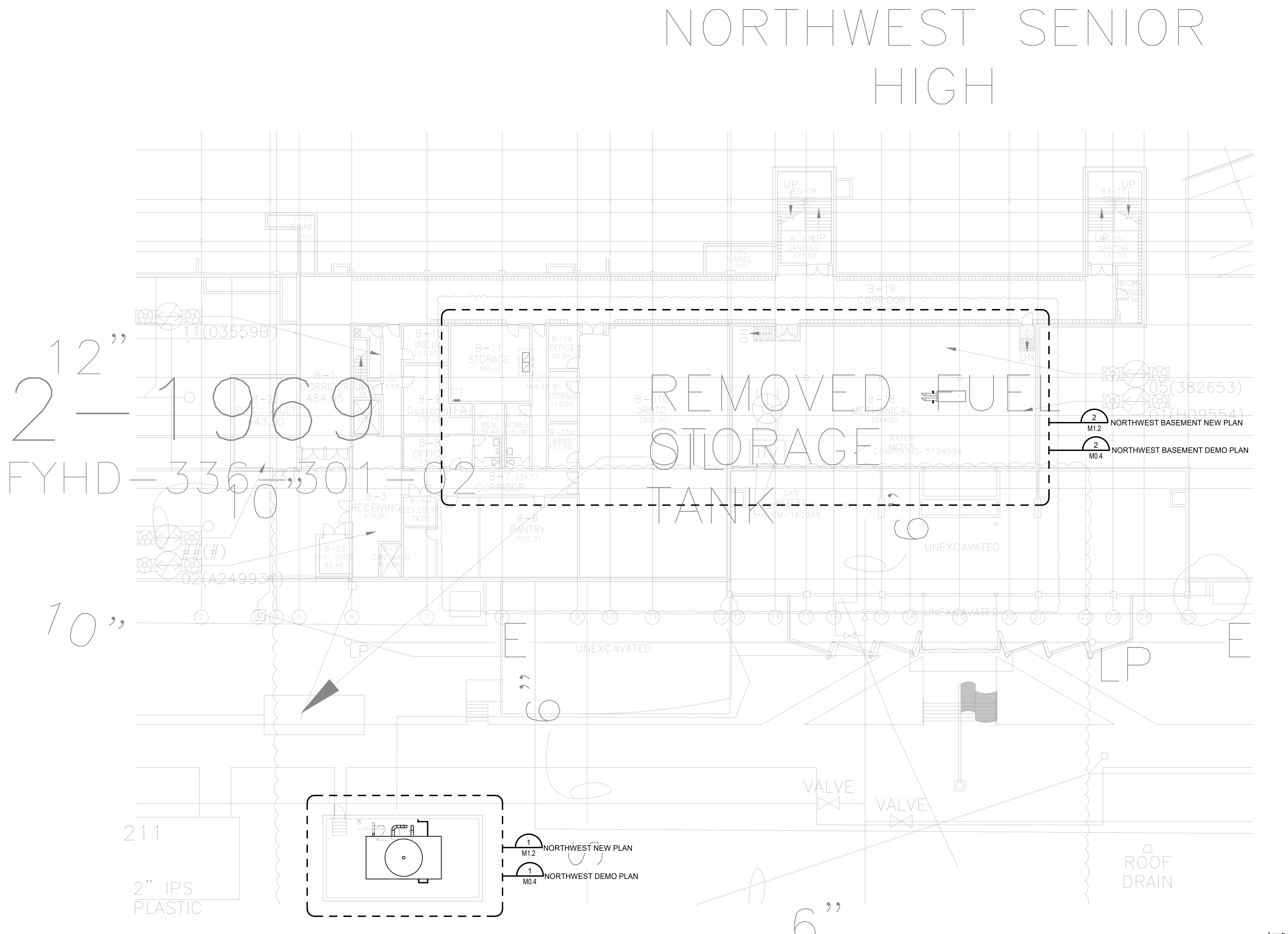
E-15785
STATE OF NEBRASKA
7/16/2025

PROJECT: 25023
DATE: 07/16/2025

SHEET M0.1



NORTHWEST MECHANICAL KEY PLAN

SCALE: 1/16" = 1'-0"

0' 4' 8' 16' 32' 48'

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

NORTHWEST MECHANICAL KEY PLAN

BDH ENGINEERING
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440 Regency Parkway,
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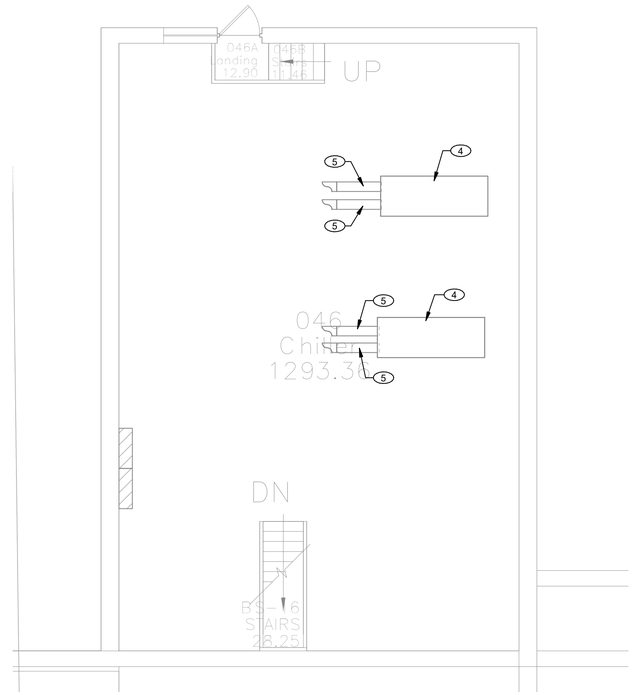
PROFESSIONAL MECHANICAL ENGINEER
BRIAN D. HOWELL
E-15785
STATE OF NEBRASKA
[illegible]
7/16/2025

PROJECT: 25023
DATE: 07/16/2025
SHEET M0.2

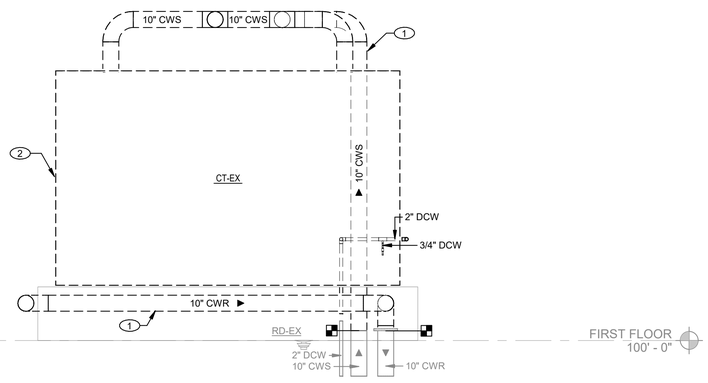


2 M0.3 NORTH BASEMENT MECHANICAL DEMOLITION PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

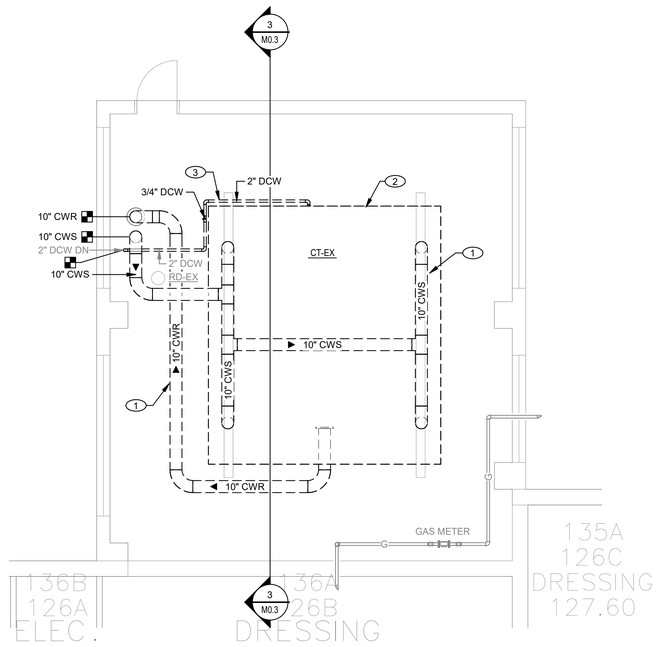
NORTH



3 M0.3 NORTH SCHOOL SECTION AT PIPING DEMOLITION

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

0' 1' 2' 4' 6' 12'



1 M0.3 NORTH MECHANICAL DEMOLITION PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH

MECHANICAL DEMOLITION NOTES:

A. SEE SHEET M0.0 FOR MECHANICAL SYMBOLS LEGEND AND GENERAL PLUMBING DEMOLITION NOTES.

KEYNOTES	
1	REMOVE ALL PIPING FROM TOWER TO FLANGE AT GROUND PENETRATION. LOWER TOWER SUPPLY PIPING CONNECTION POINT AS LOW AS POSSIBLE.
2	REMOVE EXISTING TOWER AND ALL ASSOCIATED COMPONENTS. PREPARE EXISTING CONCRETE SUPPORTS TO ACCEPT NEW STEEL EXTENSION AND NEW TOWER.
3	REMOVE MAKE UP WATER BACK TO ISOLATION VALVE. REMOVE ISOLATION VALVE AND PREPARE PIPING FOR NEW VALVE.
4	EXISTING CHILLER TO REMAIN.
5	PREPARE CONDENSER WATER PIPING AT CHILLER FOR NEW 1" TAP FOR NEW NO SCALE SYSTEM.

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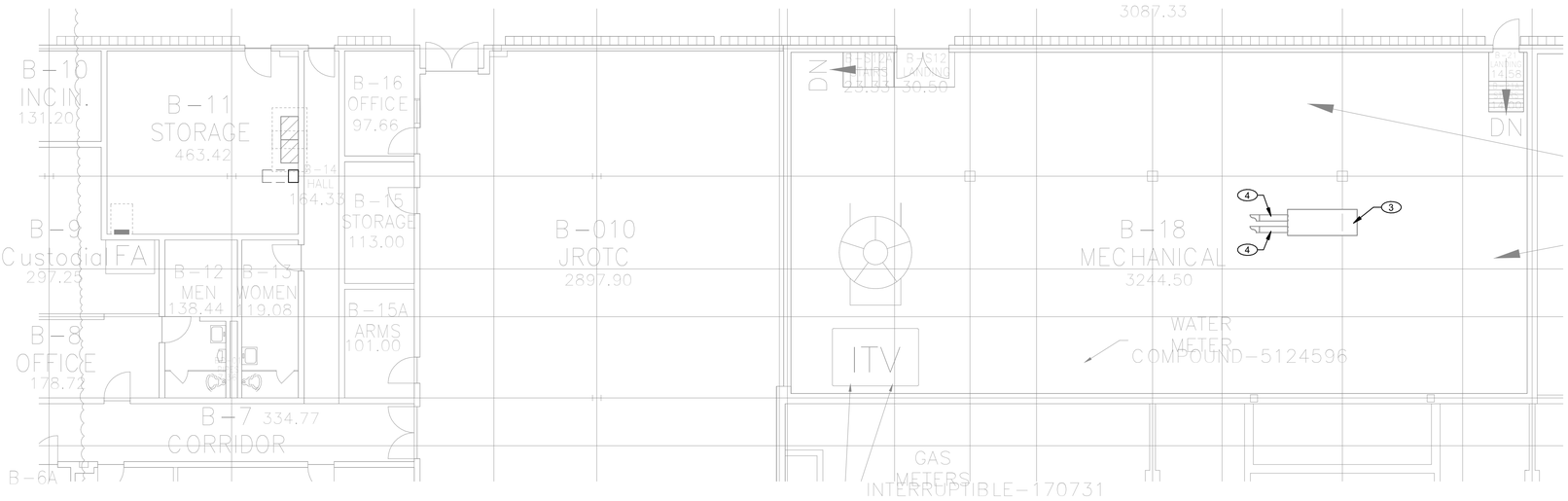
SHEET M0.3

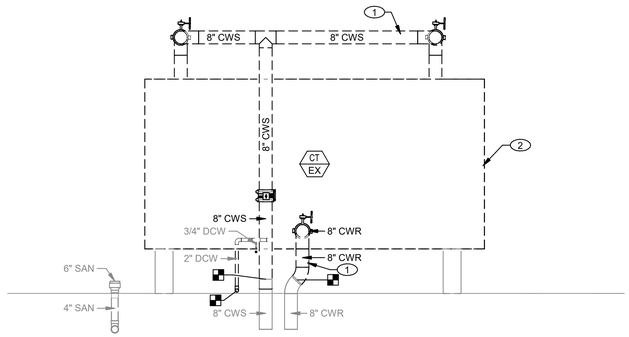


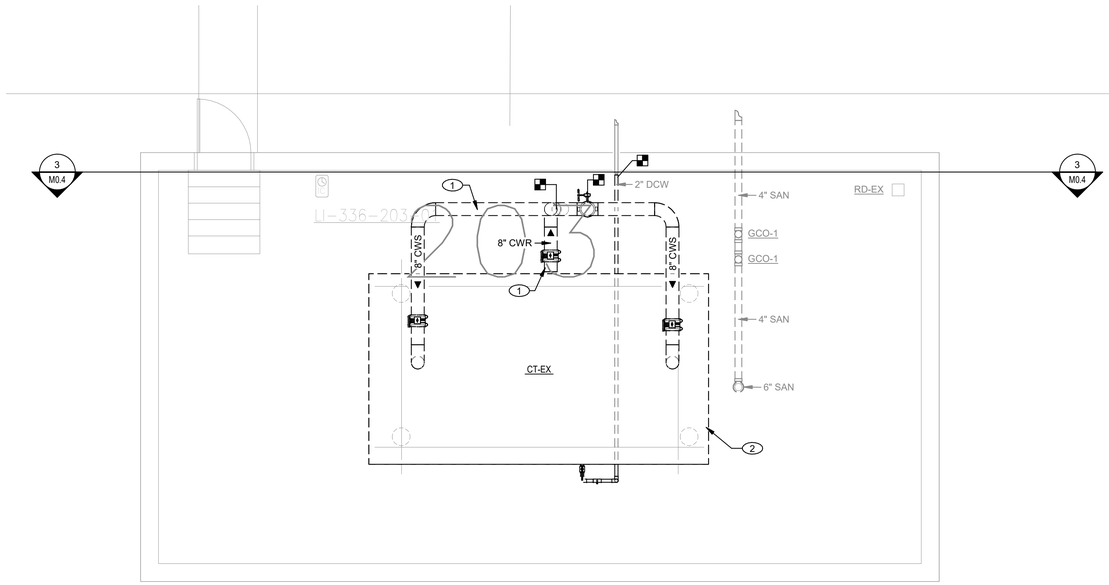
2 M0.4 NORTHWEST BASEMENT MECHANICAL DEMOLITION PLAN

SCALE: 1/8" = 1'-0"

0' 2' 4' 8' 16' 24'

NORTH





3 M0.4 NORTHWEST SECTION AT PIPING DEMOLITION

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

0' 1' 2' 4' 6' 12'

1 M0.4 NORTHWEST MECHANICAL DEMOLITION PLAN

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

0' 1' 2' 4' 6' 12'

NORTH

MECHANICAL DEMOLITION NOTES:

A. SEE SHEET M0.0 FOR MECHANICAL SYMBOLS LEGEND AND GENERAL PLUMBING DEMOLITION NOTES.

KEYNOTES	
1	REMOVE ALL PIPING FROM TOWER TO FLANGE AT GROUND PENETRATION. LOWER TOWER SUPPLY PIPING CONNECTION POINT AS LOW AS POSSIBLE.
2	REMOVE EXISTING TOWER AND ALL ASSOCIATED COMPONENTS. PREPARE EXISTING CONCRETE SUPPORTS TO ACCEPT NEW STEEL EXTENSION AND NEW TOWER.
3	PROVIDE 12" TALL W12X26 GALVANIZED BEAM ON EXISTING SUPPORT STRUCTURE. SECURE BEAM TO SUPPORT AND SECURE TOWER TO BEAM.
4	PREPARE CONDENSER WATER PIPING AT CHILLER FOR NEW 1" TAP FOR NEW NO SCALE SYSTEM.

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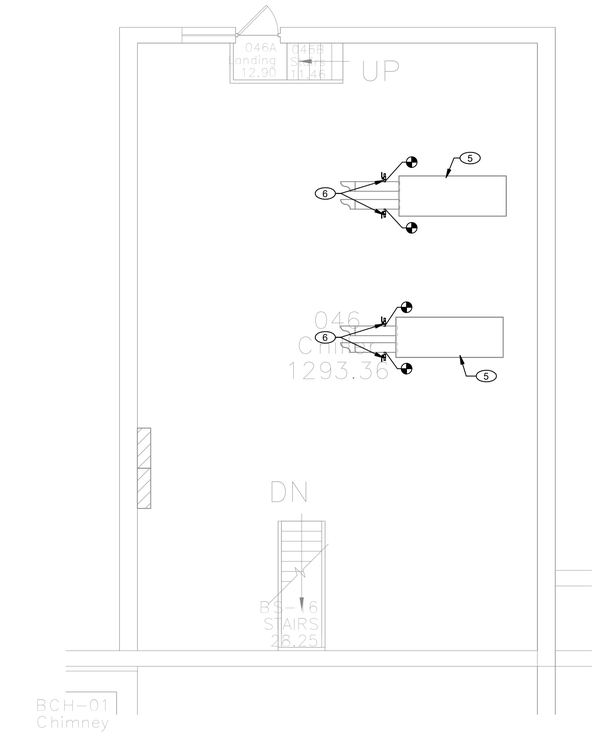
7/16/2025

PROJECT: 25023

DATE: 07/16/2025

SHEET M0.4

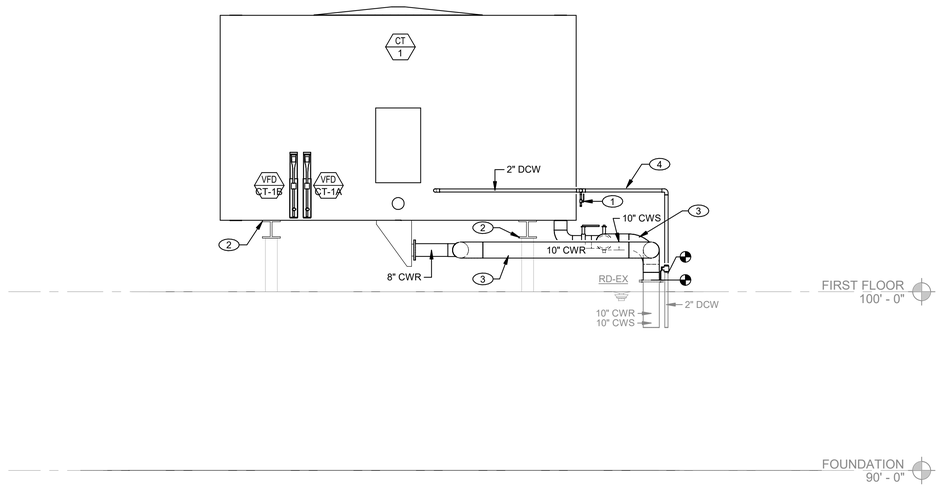


2 M1.1 NORTH BASEMENT MECHANICAL PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH



3 M1.1 NORTH SCHOOL SECTION AT PIPING

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

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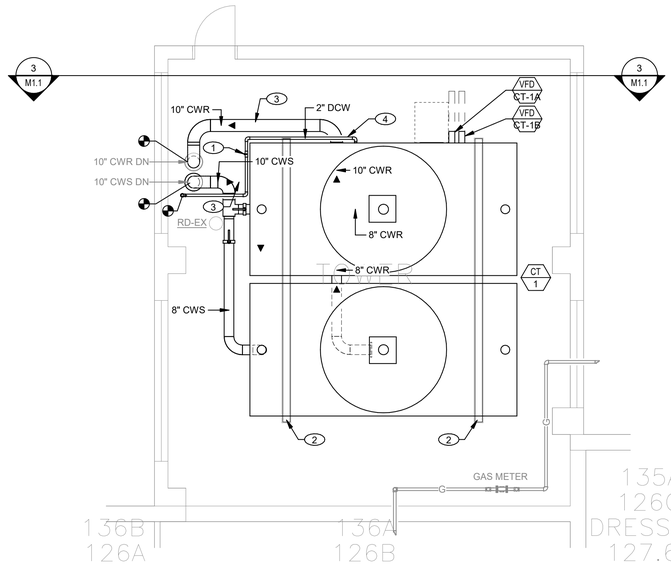

1 M1.1 NORTH MECHANICAL PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH

MECHANICAL PIPING NOTES:

A. SEE SHEET M0.0 FOR MECHANICAL SYMBOLS LEGEND AND GENERAL MECHANICAL NOTES.
B. SUPPORT PIPING FROM STRUCTURE AS REQUIRED. SEE PIPE SUPPORT DETAIL FOR ADDITIONAL INFORMATION.

KEYNOTES	
1	PROVIDE 3/4" THREADED HOSE CONNECTION WITH BALL VALVE FOR ISOLATION.
2	PROVIDE 12" TALL W12X26 GALVANIZED BEAM ON EXISTING SUPPORT STRUCTURE. SECURE BEAM TO SUPPORT AND SECURE TOWER TO BEAM.
3	PROVIDE HEAT TRACE ON COOLING TOWER SUPPLY AND RETURN PIPING. HEAT TRACE SHALL BE 8 W/FT AND BE DESIGNED TO MAINTAIN THE PIPE AT 38 DEG F WITH AN OUTDOOR TEMPERATURE OF 10 DEG F. INSULATE CONDENSER WATER PIPING OVER THE HEAT TRACE WITH A MINIMUM OF 1-1/2" FIBERGLASS INSULATION AND ALUMINUM JACKETING. PROVIDE HEAT TRACE CONTROL SYSTEM TO AUTOMATICALLY MAINTAIN DESIRED TEMPERATURE. INSTALL HEAT TRACE PER MANUFACTURER RECOMMENDATIONS.
4	PROVIDE HEAT TRACE ON MAKE UP WATER PIPING. HEAT TRACE SHALL BE 6 W/FT AND BE DESIGNED TO MAINTAIN THE PIPE AT 38 DEG F WITH AN OUTDOOR TEMPERATURE OF 10 DEG F. INSULATE MAKE UP WATER PIPING OVER THE HEAT TRACE WITH A MINIMUM OF 1-1/2" FIBERGLASS INSULATION AND ALUMINUM JACKETING. PROVIDE HEAT TRACE CONTROL SYSTEM TO AUTOMATICALLY MAINTAIN DESIRED TEMPERATURE. INSTALL HEAT TRACE PER MANUFACTURER RECOMMENDATIONS.
5	EXISTING CHILLER TO REMAIN.
6	PROVIDE 1" TAP AND BALL VALVE FOR CONNECTION OF NO SCALE SYSTEM. COORDINATE INSTALLATION WITH INSTALLING CONTRACTOR FOR THAT SYSTEM.

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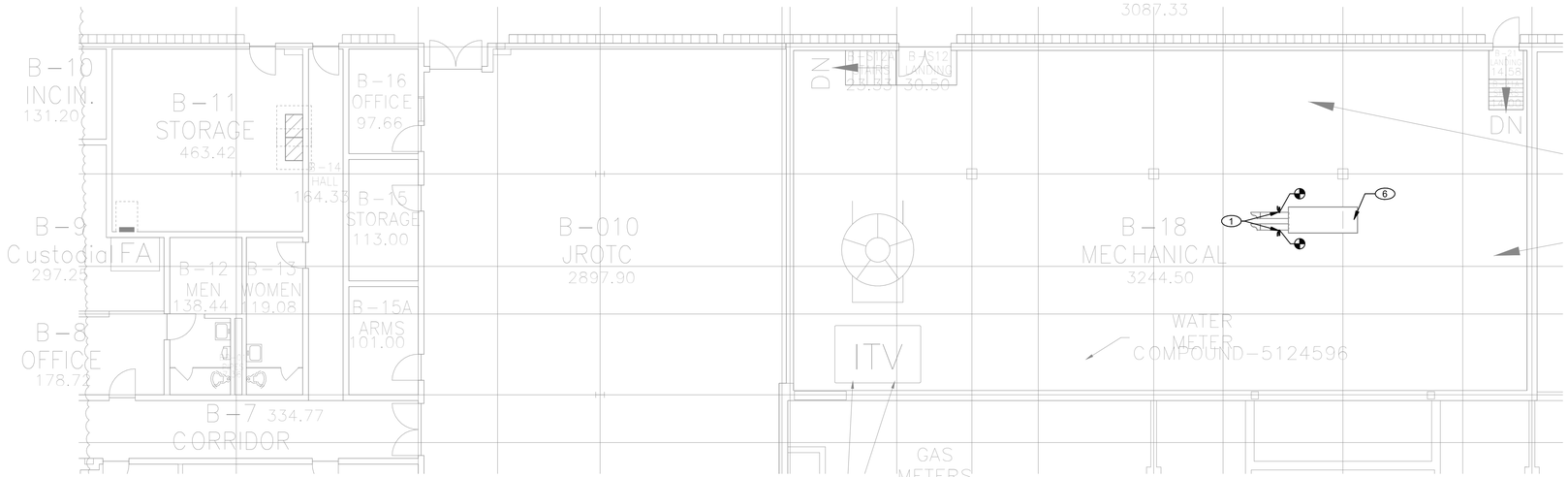
7/16/2025

PROJECT: 25023
DATE: 07/16/2025

SHEET M1.1

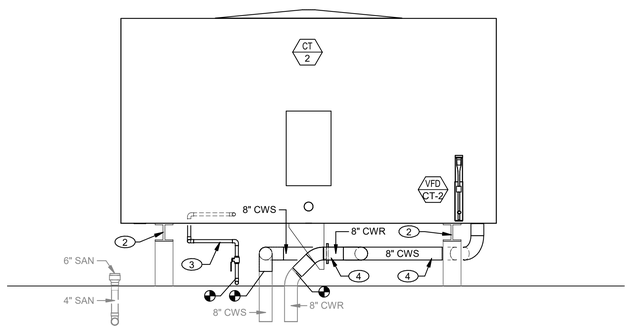


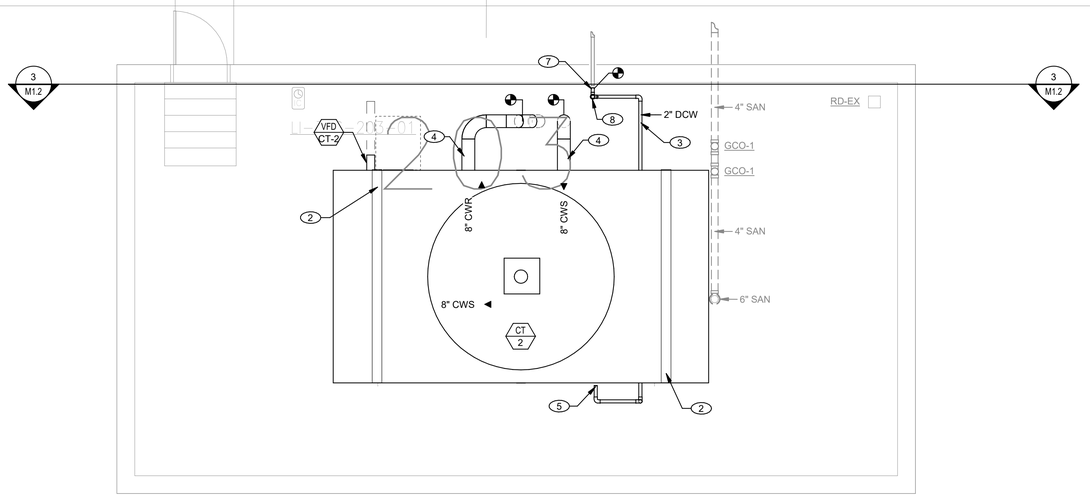
2 M1.2 NORTHWEST BASEMENT MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

0' 2' 4' 8' 16' 24'

NORTH





3 M1.2 NORTHWEST SECTION AT PIPING

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

0' 1' 2' 4' 6' 12'

1 M1.2 NORTHWEST MECHANICAL PLAN

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

0' 1' 2' 4' 6' 12'

NORTH

MECHANICAL PIPING NOTES:

A. SEE SHEET M0.0 FOR MECHANICAL SYMBOLS LEGEND AND GENERAL MECHANICAL NOTES.
B. SUPPORT PIPING FROM STRUCTURE AS REQUIRED. SEE PIPE SUPPORT DETAIL FOR ADDITIONAL INFORMATION.

KEYNOTES	
1	PROVIDE 1" TAP AND BALL VALVE FOR CONNECTION OF NO SCALE SYSTEM. COORDINATE INSTALLATION WITH INSTALLING CONTRACTOR FOR THAT SYSTEM.
2	PROVIDE 12" TALL W12X26 GALVANIZED BEAM ON EXISTING SUPPORT STRUCTURE. SECURE BEAM TO SUPPORT AND SECURE TOWER TO BEAM.
3	PROVIDE HEAT TRACE ON MAKE UP WATER PIPING. HEAT TRACE SHALL BE 6 W/FT AND BE DESIGNED TO MAINTAIN THE PIPE AT 38 DEG F WITH AN OUTDOOR TEMPERATURE OF 10 DEG F. INSULATE MAKE UP WATER PIPING OVER THE HEAT TRACE WITH A MINIMUM OF 1-1/2" FIBERGLASS INSULATION AND ALUMINUM JACKETING. PROVIDE HEAT TRACE CONTROL SYSTEM TO AUTOMATICALLY MAINTAIN DESIRED TEMPERATURE. INSTALL HEAT TRACE PER MANUFACTURER RECOMMENDATIONS.
4	PROVIDE HEAT TRACE ON COOLING TOWER SUPPLY AND RETURN PIPING. HEAT TRACE SHALL BE 8 W/FT AND BE DESIGNED TO MAINTAIN THE PIPE AT 38 DEG F WITH AN OUTDOOR TEMPERATURE OF 10 DEG F. INSULATE CONDENSER WATER PIPING OVER THE HEAT TRACE WITH A MINIMUM OF 1-1/2" FIBERGLASS INSULATION AND ALUMINUM JACKETING. PROVIDE HEAT TRACE CONTROL SYSTEM TO AUTOMATICALLY MAINTAIN DESIRED TEMPERATURE. INSTALL HEAT TRACE PER MANUFACTURER RECOMMENDATIONS.
5	COORDINATE EXACT MAKE UP WATER CONNECTION LOCATION WITH COOLING TOWER MANUFACTURER DRAWINGS.
6	EXISTING CHILLER TO REMAIN.
7	MODIFY EXISTING DOMESTIC COLD WATER TAP IN TOWER ENCLOSURE TO CLEANLY COME OUT OF THE GROUND. TURN PIPE UP AT WALL. INSULATE AND HEAT TRACE TO AT LEAST 10" BELOW GRADE.
8	INSTALL ISOLATION VALVE IN VERTICAL PIPING.

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STATE OF NEBRASKA
7/16/2025

PROJECT: 25023
DATE: 07/16/2025

SHEET M1.2

COOLING TOWER

MARK	SERVES	TOWER CONFIGURATION	NUMBER OF CELLS	CAPACITY (TONS)	AMBIENT TEMP DB/WB (°F)	MAX FLOWRATE (GPM)	EWT (° F)	LWT (°F)	PRESS DROP (FT)	INLET CONNECTION (IN)	INLET HEIGHT (IN)	OUTLET CONNECTION (IN)	FAN DATA					ELECTRICAL			BASIN HEAT	OPERATING WEIGHT (LBS)	MANUFACTURER & MODEL NO.	REMARKS
													NO.	TYPE	FAN SPEED (RPM)	AIRFLOW (CFM)	HP	V	PH	SCCR (A)	CAPACITY			
CT-1	NORTH	CROSSFLOW	2	1000	95/78	2400	95/78	85	10	(2) @ 8"	BOTTOM	(2) @ 8"	2	GEAR	330	102,030	15 EA.	480	3	5000	18 KW PER CELL	19,180 EACH	MARLEY NC8405PAN	1-9
CT-2	NORTH WEST	CROSSFLOW	1	700	95/78	1700	95/78	85	10	10"	BOTTOM	10"	1	GEAR	347	165,300	40	480	3	5000	24 KW	24,420	MARLEY NC8407TAN	1-9

REMARKS:

1. 301L STAINLESS STEEL COLLECTION AND DISTRIBUTION BASINS, GALVANIZED STEEL STRUCTURE AND CASING, GEAR DRIVE WITH MOTOR MOUNTED OUTSIDE THE AIRSTREAM, EXTENDED LUBE LINE, ENHANCED ACCOUSTICAL PERFORMANCE QUIET FAN
2. 15 MIL PVC FILL WITH INTEGRAL LOUVERS AND DRIFT ELIMINATORS, GALVANIZED AIR INLET SCREENS, ONE 8" BOTTOM HOT WATER INLETS WITH INTEGRAL PVC PIPING FOR BALANCED DISTRIBUTION PER CELL, FLOAT TYPE MAKEUP VALVE
3. ACCESS DOOR PLATFORM ON BOTH CASED FACES, FAN DECK LADDER WITH SAFETY CAGE ON BOTH CASED FACES, LADDER EXTENTIONS TO GRADE, FAN DECK GUARDRAIL, FIBERGLASS VELOCITY RECOVERY STACK, AND STAINLESS STEEL PLENUM WALKWAY
4. REMOTE VARIABLE FREQUENCY DRIVE WITH DISCONNECT, SHAFT GROUNDING RING, AND EXTERNALLY MOUNTED MANUAL RESET VIBRATION SWITCH
5. 8" DEPRESSED SIDE SUMP OUTLET WITH TRASH SCREEN AND ANTI VORTEX PLATE PER CELL, OUTLET ON BOTTOM OF TOWER. STEEL SUMP SIDE OUTLET WITH SCREEN.
6. TOWER TO INCLUDE SINGLE POINT POWER CONTROL PANEL FOR FAN AND HEATER POWER. VFD TO BE MOUNTED REMOTE TO PANEL.
7. CTI CERTIFIED PER STD-201
8. ALTERNATE TOWER MANUFACTURERS ARE ALLOWED. CONTRACTOR RESPONSIBLE FOR ANY MODIFICATIONS FOR ALTERNATE TOWER SELECTIONS.
9. 5-YEAR WHOLE UNIT PARTS ONLY WARRANTY

NORTH AND NORTHWEST TOWER CONTROL SEQUNCE

GENERAL: COOLING TOWER SEQUENCE OF OPERATION IS NOT INTENDED TO MODFIY OR OVERRIDE THE EXISTING CHILLER SEQUENCE OF OPERATION. EXISTING CHILLER CONTROL POINTS LISTED IN THIS SEQUENCE ARE APPROXIMATE.

COOLING TOWER ENABLE: UPON CHILLER ENABLE SIGNAL THE BMS SHALL ENABLE COOLING TOWER SYSTEM AND CLOSE THE COOLING TOWER BYPASS VALVE.

COOLING TOWER OPERATION: BMS SHALL MONITOR THE CONDENSER WATER SUPPLY TEMPERATURE. UPON RISE IN SUPPLY TEMPERATURE ABOVE 75 DEG F THE COOLING TOWER FAN SHALL START. BMS SHALL MODULATE THE COOLING TOWER FAN VFD TO MAINTAIN CONDENSER WATER SETPOINT.

CONDENSER WATER SETPOINT: CONDENSER WATER SETPOINT SHALL BE SET BY THE BMS. BMS SHALL MONITOR THE OUTDOOR WET BULB TEMPERATURE AND SET THE CONDENSER WATER SUPPLY TEMPERATURE TO 7 DEG F HIGHER THAN THE ACTUAL OUTDOOR WETBULB TEMPERATURE.

FAULT DETECTION: BMS SHALL MONITOR THE COOLING TOWER STATUS AND FAN VIBRATION. UPON LOSS OF STATUS BMS SHALL SIGNAL AN ALARM. UPON DETECTION OF FAN VIBRATION THE BMS SHALL DISABLE THE COOLING TOWER AND SIGNAL AN ALARM AT THE BMS TERMINAL.

VARIABLE FREQUENCY DRIVE SCHEDULE

MARK	SERVES	LOCATED	MOTOR SIZE (HP)	ELECTRICAL			MANUFACTURER & MODEL NO.	REMARKS
				A	V	PH		
VFD-CT-1A	COOLING TOWER CT-1	ON TOWER	15	21.0	480.0	3	YASKAWA	1
VFD-CT-1B	COOLING TOWER CT-1	ON TOWER	15	21.0	480.0	3	YASKAWA	1
VFD-CT-2	COOLING TOWER CT-2	ON TOWER	40	52.0	480.0	3	YASKAWA	1

REMARKS:

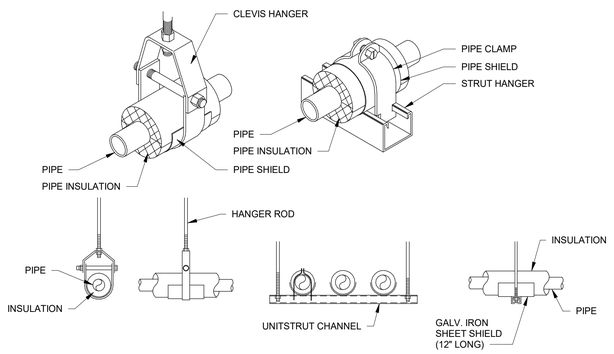
1. VFD TO BE RATED FOR OUTDOOR OPERATION.

PIPING APPLICATION SCHEDULE

SYSTEM DESCRIPTION	SIZE	MATERIAL	JOINTS	INSULATION		NOTES
				TYPE	THICKNESS	
DOMESTIC COLD WATER - OUTDOOR W/ HEAT TRACE	ALL	COPPER (TYPE L)	SOLDER	FIBERGLASS WITH ALUMINUM JACKET	1"	A
CONDENSER WATER OUTDOOR W/ HEAT TRACE	ALL	CPVC	SOLVENT	FIBERGLASS WITH ALUMINUM JACKET	1-1/2"	A

NOTES:

A) PROVIDE ALUMINUM JACKETED INSULATION WHEN LOCATED OUTDOORS



NOTES:

1. ATTACH SUPPORTS FOR ALL PIPING SUSPENDED FROM THE STEEL STRUCTURE TO THE TOP CORD OF JOISTS OF BEAMS.
2. PROVIDE COPPER OR PLASTIC COATED HANGERS FOR NON-INSULATED COPPER PIPE.
3. PROVIDE AND INSTALL B-LINE OR ACCEPTABLE INSULATED GALVANIZED STEEL JACKET AND HANGER, STRUT MOUNTED CLAMP AND PIPE SUPPORT LOCATIONS.

1 / M7.1 PIPE SUPPORT DETAIL
NOT TO SCALE

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OMAHA, NE

MECHANICAL DETAILS AND SCHEDULES

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7/16/2025

PROJECT: 25023
DATE: 07/16/2025

SHEET M7.1

ELECTRICAL SYMBOLS LEGEND

(AS APPLICABLE)

SWITCHING

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
Sa	SINGLE POLE SWITCH - LETTER INDICATES SWITCH LEG	SM	MOMENTARY CONTACT SWITCH
S2	DOUBLE POLE SWITCH	SK	KEY OPERATED SWITCH
S3	THREE-WAY SWITCH	SP	PILOT LIGHT SWITCH
S4	FOUR-WAY SWITCH	ST	TIMER SWITCH
SD	DIMMER SWITCH	SS	SENSOR SWITCH - WALL MOUNTED: SEE LIGHTING CONTROL SCHEME NARRATIVE FOR TYPE
SH	HORSEPOWER RATED SWITCH	S,#	SENSOR - CEILING MOUNTED: SEE LIGHTING CONTROL SCHEME NARRATIVE FOR TYPE
SF	FUSED SWITCH	S,#	SENSOR - WALL MOUNTED: SEE LIGHTING CONTROL SCHEME NARRATIVE FOR TYPE
STE	THERMAL ELEMENT	DS,#	DAYLIGHTING SENSOR - CEILING MOUNTED
(a)	LIGHTING CONTROL STATION - LETTER INDICATES TYPE		

NUMBER INDICATES ZONE OF LUMINAIRES TO BE CONTROLLED BY SENSOR(S). NO NUMBER INDICATES ALL ROOM LUMINAIRES TO BE CONTROLLED BY SENSOR(S).

LIGHTING

LABEL INFORMATION ○ A, # — LETTER INDICATES LUMINAIRE MARK, NUMBER INDICATES ZONE IDENTIFIER, NO NUMBER INDICATES SINGLE ZONE

	LUMINAIRE		WALL MOUNTED LUMINAIRE
	LUMINAIRE - LAMPS SWITCHED SEPARATE		WALL MOUNTED LUMINAIRE - NIGHT LIGHT
	LUMINAIRE WITH AUXILIARY LIGHT		WALL MOUNTED LUMINAIRE - EMERGENCY
	LUMINAIRE - EMERGENCY		EXIT SIGN - WALL/CEILING MOUNTED
	LUMINAIRE - NIGHT LIGHT		EXIT SIGN/EMERGENCY LUMINAIRE COMBINATION WALL/CEILING MOUNTED
	WALL MOUNTED LUMINAIRE		PHOTOCELL, DAYLIGHT SENSOR
	WALL MOUNTED LUMINAIRE - EMERGENCY		EXTERIOR LUMINAIRE - POLE MOUNTED
	WALL MOUNTED LUMINAIRE - NIGHT LIGHT		EXTERIOR LUMINAIRE - POLE MOUNTED
	STRIP LUMINAIRE		EXTERIOR LUMINAIRE - POLE MOUNTED
	STRIP LUMINAIRE - EMERGENCY		EXTERIOR LUMINAIRE - POLE MOUNTED
	STRIP LUMINAIRE - NIGHT LIGHT		FLOOD LIGHT LUMINAIRE
	LUMINAIRE		EMERGENCY BATTERY PACK
	LUMINAIRE - NIGHT LIGHT		EMERGENCY LUMINAIRE REMOTE HEADS
	LUMINAIRE - EMERGENCY		TRACK LUMINAIRE

POWER DEVICES

	SINGLE RECEPTACLE		LIGHTING & APPLIANCE PANELBOARD
	DUPLEX RECEPTACLE		POWER DISTRIBUTION EQUIPMENT
	FOUR-PLEX RECEPTACLE - TWO DUPLEX RECEPTACLES	T	TRANSFORMER
	RANGE RECEPTACLE		ENCLOSED CIRCUIT BREAKER
	SPECIAL RECEPTACLE		CABINET (TYPE INDICATED)
G	DUPLEX RECEPTACLE - GROUND-FAULT CIRCUIT-INTERRUPTER		MOTOR STARTER, LIGHTING CONTACTOR
IG	DUPLEX RECEPTACLE - ISOLATED GROUND		SAFETY SWITCH
WR	DUPLEX RECEPTACLE - WEATHER-RESISTANT GROUND-FAULT CIRCUIT-INTERRUPTER		COMBINATION MOTOR STARTER & SAFETY SWITCH
A	DUPLEX RECEPTACLE - ON APPLIANCE CIRCUIT		MOTOR
T	DUPLEX RECEPTACLE - TAMPER-RESISTANT	J	CORD DROP (J-BOX AT CEILING)
F	DUPLEX RECEPTACLE - ARC-FAULT RATED		CORD DROP (SPECIAL RECEPTACLE AT CEILING)
M	DUPLEX RECEPTACLE - MOUNTED IN MILLWORK		MULTI-OUTLET ASSEMBLY
B	DUPLEX RECEPTACLE - MOUNTED BELOW COUNTER		FLUSH FLOOR BOX
	DUPLEX RECEPTACLE - CEILING MOUNTED		FLUSH POKE-THRU
	DUPLEX RECEPTACLE - BOTTOM HALF SWITCHED		DAMPER
	SPLIT-WIRE RECEPTACLE	S	SOLENOID
J	JUNCTION BOX		

RACEWAYS

	HOME RUN TO PANEL	T	TELEPHONE CONDUIT
N	UNSWITCHED LIGHTING CIRCUIT		CONDUIT UP
M	MASTER SATELLITE FIXTURE CONNECTION		CONDUIT DOWN
E	EMERGENCY CIRCUIT		CONDUIT SEAL
NL	NIGHT LIGHTING CIRCUIT		CABLE TRAY
S	SOUND SYSTEM RACEWAY	#"	CONDUIT SLEEVE (NUMBER INDICATES SIZE)

MISCELLANEOUS

XX / X	EQUIPMENT IDENTIFICATION TAG	WP	WEATHER-PROOF
X / XXX	DETAIL REFERENCE / SHEET REFERENCE	WG	WIRE GUARD
FACP	FIRE ALARM CONTROL PANEL	XP	EXPLOSION PROOF
FAAP	FIRE ALARM ANNUNCIATOR PANEL	30/3/10/3R	RATED AMPACITY/NO. POLES/FUSING REQ'D/NEMA ENCL. NO.
HOA	HAND-OFF-AUTO	PX	PROJECTOR INPUT STATION - LETTER INDICATES TYPE
CCT.	CIRCUIT		PROJECTOR CONTROL STATION
PART. CCT.	PARTIAL CIRCUIT		LIGHT LINEWORK = EXISTING
NF	NON-FUSED		DARK/DASHED LINEWORK = DEMOLITION
			DARK LINEWORK = NEW

COMMUNICATIONS

W	TELEPHONE OUTLET - WALL MOUNTED		TELEPHONE CABINET
#	TELEPHONE OUTLET BOX	C	CLOCK HANGER OUTLET
#	DATA OUTLET BOX	C	CLOCK - WALL MOUNTED
#	PHONE OUTLET BOX - CEILING MOUNTED	C 2	CLOCK - CEILING MOUNTED (DOUBLE FACE)
#	DATA OUTLET BOX - CEILING MOUNTED	C S	CLASSROOM CLOCK & SPEAKER
WAP	WIRELESS ACCESS POINT - CEILING MOUNTED	P	PROGRAM BELL
	COMBINATION TELEPHONE/DATA OUTLET BOX - ONE JACK EACH		INTERCOM CALL SWITCH
	DATA OUTLET BOX - BLANK PLATE, 1" CONDUIT	X	INTERCOM ADMINISTRATION STATION (LETTER INDICATES TYPE)
M #	MICROPHONE OUTLET (NUMBER INDICATES QUANTITY)	X	INTERCOM CLASSROOM/STAFF STATION (LETTER INDICATES TYPE)
M #	MICROPHONE OUTLET - WALL MOUNTED (NUMBER INDICATES QUANTITY)	X	AUDIO/VISUAL AUXILIARY OUTLET (LETTER INDICATES TYPE)
L #	LINE INPUT OUTLET (NUMBER INDICATES QUANTITY)	A	T.V. ANTENNA OUTLET
L #	LINE INPUT OUTLET - WALL MOUNTED (NUMBER INDICATES QUANTITY)	V	INTERCOM/PAGING VOLUME CONTROL
S	INTERCOM/PAGING SPEAKER - CEILING MOUNTED	V	SOUND SYSTEM VOLUME CONTROL
S	INTERCOM/PAGING SPEAKER - WALL MOUNTED		GROUND BAR
S	INTERCOM/PAGING SPEAKER HORN - WALL MOUNTED		NOTE: SYMBOLS SHOWN "STACKED" ON THE FLOOR PLANS INDICATE THAT THE DEVICES ARE TO BE LOCATED IN THE SAME OUTLET BOX AND FACEPLATE. (I.E. 1 / 2)
S	SOUND SYSTEM SPEAKER - CEILING MOUNTED		
S	SOUND SYSTEM SPEAKER - WALL MOUNTED		

NUMBER BY SYMBOL INDICATES QUANTITY OF JACKS. ZERO INDICATES EMPTY OUTLET BOX , BLANK PLATE AND CONDUIT.

FIRE ALARM

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
HD R/T	HEAT DETECTOR - COMBINATION	F	FIRE ALARM HORN - CEILING MOUNTED
HD F	HEAT DETECTOR - FIXED TEMPERATURE		FIRE ALARM VISUAL SIGNAL - CEILING MOUNTED
HD EV	HEAT DETECTOR - FIXED TEMPERATURE (CONNECTED TO ELEVATOR RECALL)		FIRE ALARM COMBINATION HORN/VISUAL - CEILING MOUNTED
SD	SMOKE DETECTOR	F	FIRE ALARM SPEAKER - CEILING MOUNTED
SD DM	SMOKE DETECTOR - DUCT MOUNTED		FIRE ALARM COMBINATION SPEAKER/VISUAL - CEILING MOUNTED
SD EV	SMOKE DETECTOR (CONNECTED TO ELEVATOR RECALL)		FLOW SWITCH
F	FIRE ALARM MANUAL STATION		TAMPER SWITCH
F	FIRE ALARM HORN - WALL MOUNTED		DUCT DETECTOR REMOTE ALARM INDICATOR
	FIRE ALARM VISUAL SIGNAL - WALL MOUNTED	R	FAN SHUT-DOWN RELAY
	FIRE ALARM COMBINATION HORN/VISUAL - WALL MOUNTED		MAGNETIC DOOR HOLDER
F	FIRE ALARM SPEAKER - WALL MOUNTED	SBD	SMOKE BEAM DETECTOR
	FIRE ALARM COMBINATION SPEAKER/VISUAL - WALL MOUNTED	R	SMOKE BEAM REFLECTOR
F	FIRE ALARM BELL - WALL MOUNTED		

SECURITY

	PUSHBUTTON STATION		MOTION DETECTOR
	PUSHBUTTON STATION, 'P' INDICATES PILOT	KP	KEYPAD
	DOOR MONITOR SWITCH	ES	ELECTRIC STRIKE
	DOOR SWITCH	CR	CARD READER
	DOOR BELL CHIME/BUZZER	PS	POWER SUPPLY
	DOOR CONTACT		SECURITY CAMERA

NURSE CALL

E	NURSE CALL DOME LIGHT EMERGENCY CALLS ONLY	N2	DOUBLE BED NURSE CALL STATION (2 CORD SETS)
N	NURSE CALL DOME LIGHT EMERGENCY/NORMAL CALLS	NC	NURSE CALL ANNUNCIATOR & POWER SUPPLY
E	EMERGENCY CALL SWITCH	ND	NURSE CALL DUTY STATION
B	CODE BLUE STATION	NS	NURSE CALL STAFF STATION
N	SINGLE BED NURSE CALL STATION (1 CORD SET)		

GENERAL ELECTRICAL DEMOLITION NOTES

APPLY TO ALL ELECTRICAL SHEETS

A. COMPLETELY REMOVE ALL ELECTRICAL WIRING, CONDUIT, SWITCHES, DISCONNECTS, LUMINAIRES, AND ASSOCIATED ANCILLARY EQUIPMENT INDICATED BY BOLD, DASHED LINES OR IDENTIFIED BY NOTES. ITEMS INDICATED FOR REMOVAL ARE ONLY SUGGESTIVE OF THE AMOUNT OF DEMOLITION WORK INVOLVED. PERFORM A SITE INVESTIGATION TO AID IN DETERMINING THE COMPLETE EXTENT OF DEMOLITION WORK.

B. COORDINATE AND SCHEDULE ALL NECESSARY POWER OUTAGES WITH THE OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH SUCH WORK SO OPERATIONS IN ADJACENT OCCUPIED PORTIONS OF THE BUILDING ARE NOT INTERRUPTED OR RESTRICTED WITHOUT PRIOR APPROVAL.

C. REMOVE ALL EXISTING BRANCH CIRCUITS INDICATED AS COMPLETELY AS POSSIBLE. REMOVE EXISTING CONDUCTORS COMPLETELY FROM THEIR RACEWAYS AND DO NOT REUSE EXCEPT WHERE SPECIFICALLY INDICATED. WHERE AN EXISTING DEVICE IS REMOVED FROM AN EXISTING CIRCUIT, PROVIDE NEW WIRING AND MAINTAIN CONTINUITY OF EXISTING CIRCUIT.

D. REMOVE EXISTING SURFACE MOUNTED BOXES, CONDUIT, SURFACE METAL RACEWAY, WIREWAY, ETC. INDICATED AS COMPLETELY AS POSSIBLE. PATCH ABANDONED PENETRATIONS FROM REMOVED FASTENERS. ABANDON IN PLACE NON-ACCESSIBLE BOXES SHOWN REMOVED AND COVER WITH STAINLESS STEEL COVER PLATES. ABANDON IN PLACE NON-ACCESSIBLE CONDUIT SHOWN REMOVED AND CAP OFF IN A SUITABLE MANNER PER LOCAL INSPECTOR'S REQUIREMENTS. CHISEL RACEWAYS STUBBED FROM A CONCRETE FLOOR OR WALL 2 INCHES BELOW ADJACENT SURFACE, GROUT, AND SCREED.

E. COORDINATE REUSED EXISTING BOX AND CONDUIT LOCATIONS WITH NEW WORK LOCATIONS.

F. REMOVE ELECTRICAL WORK AT ALL MECHANICAL EQUIPMENT SHOWN REMOVED. COORDINATE EQUIPMENT REMOVAL LOCATIONS WITH MECHANICAL DRAWINGS.

GENERAL ELECTRICAL NOTES

APPLY TO ALL ELECTRICAL SHEETS

A. MOUNTING HEIGHTS INDICATED ARE TO CENTER OF ROUGH-IN ABOVE FINISHED FLOOR (AFF).

B. INSTALL ALL CONDUCTORS IN CONTINUOUS RACEWAY. PROVIDE INSULATED EQUIPMENT GROUNDING CONDUCTOR.

C. PROVIDE DEDICATED NEUTRAL CONDUCTOR FOR EACH BRANCH CIRCUIT PHASE CONDUCTOR. EXCEPTION: WHERE AN EQUIPMENT MANUFACTURER REQUIRES A MULTIWIRE BRANCH CIRCUIT FOR ONLY ONE UTILIZATION EQUIPMENT AND WHERE ALL UNGROUNDED CONDUCTORS OF THAT CIRCUIT ARE OPENED SIMULTANEOUSLY BY THE BRANCH CIRCUIT OVERCURRENT DEVICE.

D. CONCEAL ALL CONDUITS IN NEW WALLS, EXISTING STUD WALLS, OR ABOVE SUSPENDED CEILINGS.

E. WHERE CONDUIT CANNOT BE CONCEALED IN EXISTING WALL OR CEILING CAVITIES, INSTALL CONDUCTORS IN SURFACE METAL RACEWAYS; SURFACE CONDUIT OR METAL SURFACE RACEWAY AT ENGINEER'S DISCRETION.

F. PAINT SURFACE CONDUIT IN FINISHED AREAS, WHEN ALLOWED, TO MATCH SURROUNDING SURFACES. COORDINATE FINISHES WITH ARCHITECT.

G. METAL SURFACE RACEWAYS SHALL BE WIREMOLD #V500, #V700, OR #V2400 SERIES WITH FACTORY IVORY FINISH OR APPROVED EQUIVALENT. METAL SURFACE RACEWAYS FOR TELEVISION CABLE SHALL BE WIREMOLD #V700 OR LARGER. METAL SURFACE RACEWAYS FOR TELECOMMUNICATIONS CABLES SHALL BE #V2400 OR LARGER. COMPLY WITH EIA/TIA STANDARDS FOR CABLE BENDING RADIUS.

H. INSTALL EXPOSED OR CONCEALED RACEWAY NEAR METAL CORRUGATED SHEET ROOF DECKING SO NEAREST OUTER RACEWAY SURFACE IS NOT LESS THAN 6 INCHES FROM THE NEAREST SURFACE OF THE ROOF DECKING. EXCEPTION: RIGID METAL CONDUIT AND INTERMEDIATE METAL CONDUIT SHALL NOT BE REQUIRED TO MAINTAIN THIS CLEARANCE.

I. PATCH, PAINT, REPAIR OR REPLACE ALL WALLS, CEILINGS, OR OTHER BUILDING ELEMENTS DISTURBED DURING INSTALLATION OF ELECTRICAL WORK.

J. USE ROOM NUMBERS ASSIGNED BY OWNER AND NOT ROOM NUMBERS LISTED ON DRAWINGS FOR LABELING OF PANELBOARD DIRECTORIES, FIRE ALARM PANEL PROGRAMMING, ETC. INCLUDE A DESCRIPTION OF LOAD SUCH AS LIGHTS, RECEPTACLES, MECHANICAL UNIT LOCATIONS, ETC. ON TYPED PANELBOARD DIRECTORIES.

K. REFER TO MECHANICAL/ELECTRICAL COORDINATION SCHEDULE SHEET FOR ADDITIONAL REQUIREMENTS ON DISCONNECTS, MOTOR STARTERS, ETC.

NOTICE:
DO NOT SCALE DRAWINGS. VERIFY ALL DIMENSIONS AND CLEARANCES FROM ARCHITECTURAL, STRUCTURAL, SHOP AND OTHER APPROPRIATE DRAWINGS OR AT SITE. LAY OUT AND COORDINATE ALL WORK PRIOR TO INSTALLATION TO PROVIDE CLEARANCES REQUIRED FOR OPERATION, MAINTENANCE, AND CODES. VERIFY NON-INTERFERENCE WITH OTHER WORK. DO NOT FABRICATE PRIOR TO VERIFICATION OF CLEARANCES FOR ALL TRADES. THIS NOTICE APPLIES TO ALL ELECTRICAL PLANS.

ELECTRICAL

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

OMAHA, NE

ELECTRICAL SYMBOLS LEGEND AND GENERAL NOTES

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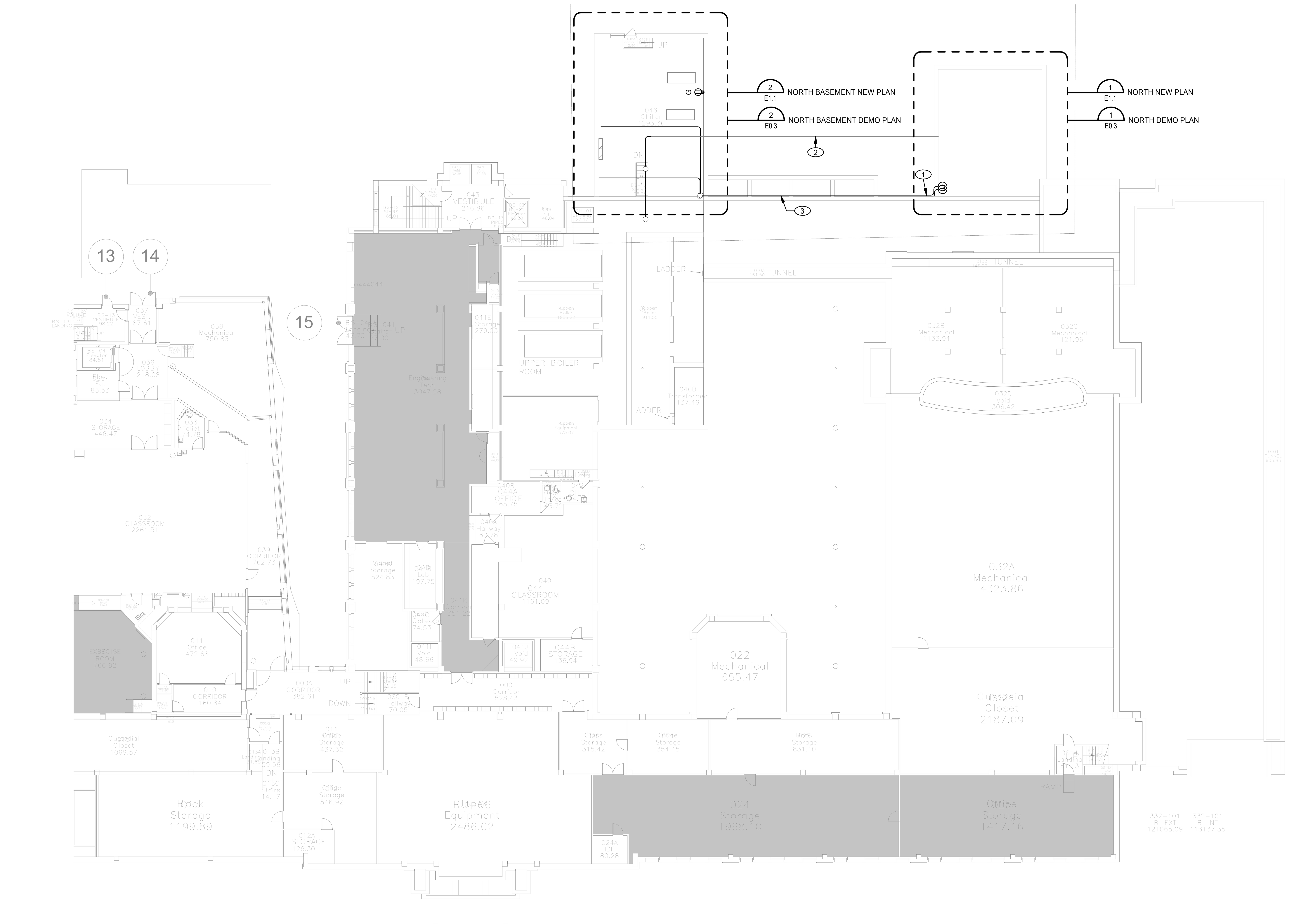
PROFESSIONAL MECHANICAL ENGINEER — BRIAN D. HOWELL E-15785 — STATE OF NEBRASKA

7/16/2025

PROJECT: 25023

DATE: 07/16/2025

SHEET E0.0



NORTH

NORTH ELECTRICAL KEY PLAN

SCALE: 1/16" = 1'-0"

0' 4' 8' 16' 32' 48'

KEYNOTES	
1	PROVIDE (2) 3/4" CONDUITS FOR 120 VOLT POWER AND CONTROL CIRCUITS FROM BASEMENT TO COOLING TOWER.
2	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
3	ROUTE CONDUIT UP EXTERIOR WALL AND ACROSS BUILDING ON ROOFTOP.

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NORTH ELECTRICAL KEY

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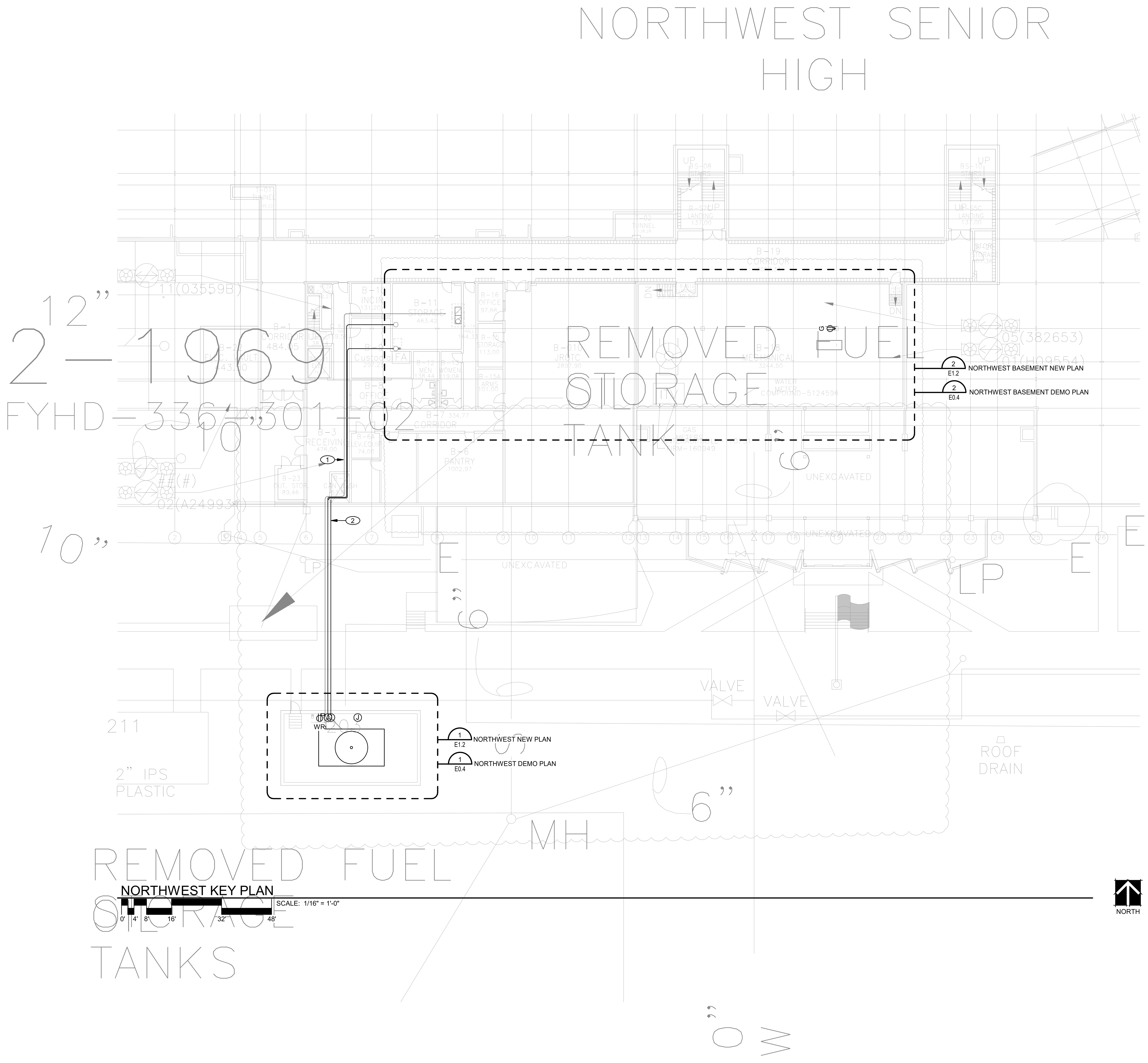
PROFESSIONAL MECHANICAL ENGINEER
BRIAN D. HOWELL
E-15785
STATE OF NEBRASKA
7/16/2025

PROJECT: 25023
DATE: 07/16/2025
SHEET E0.1

KEYNOTES

1	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
2	PROVIDE (2) 3/4" CONDUITS FOR 120 VOLT POWER AND CONTROL CIRCUITS FROM BASEMENT TO COOLING TOWER.



NORTHWEST KEY PLAN

SCALE: 1/16" = 1'-0"

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

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NORTHWEST ELECTRICAL KEY PLAN

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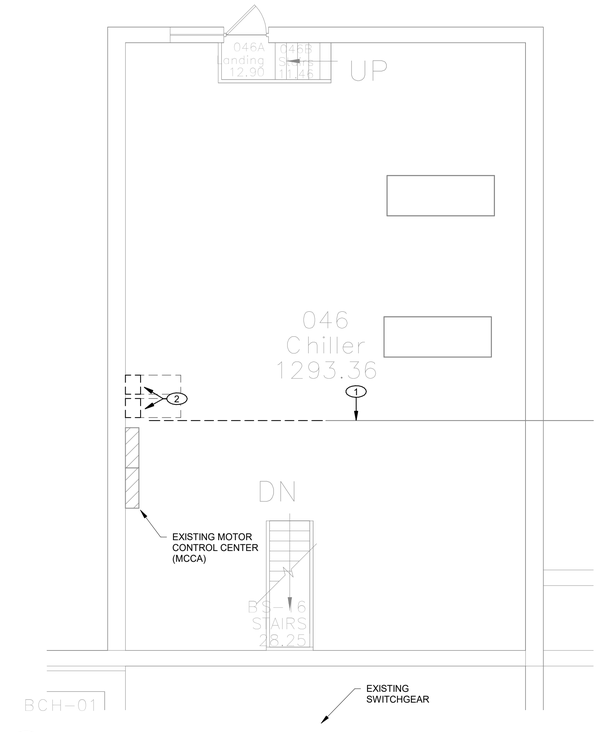
PROFESSIONAL MECHANICAL ENGINEER BRIAN D. HOWELL E-15785 STATE OF NEBRASKA
7/16/2025

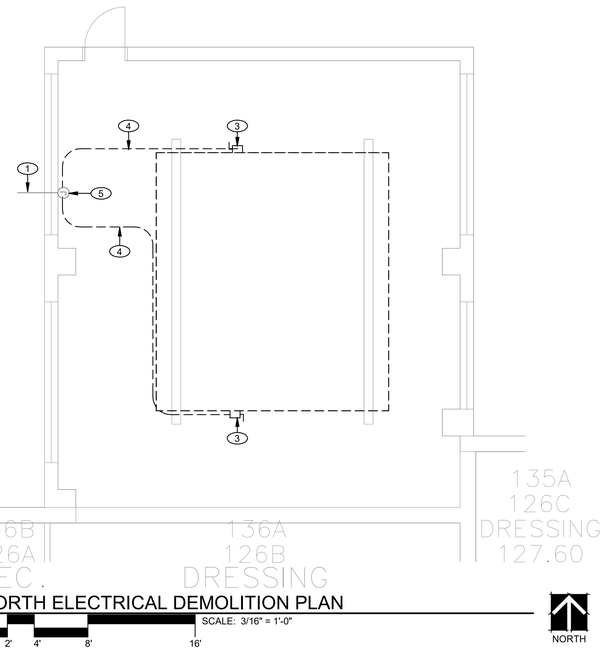
PROJECT: 25023
DATE: 07/16/2025
SHEET E0.2



2 E0.3 NORTH BASEMENT ELECTRICAL DEMOLITION PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'



1 E0.3 NORTH ELECTRICAL DEMOLITION PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH

ELECTRICAL DEMOLITION NOTES:

A. SEE SHEET E0.0 FOR ELECTRICAL SYMBOLS LEGEND AND GENERAL ELECTRICAL DEMOLITION NOTES.

KEYNOTES	
1	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
2	EXISTING VFD'S TO BE REMOVED AND RETURNED TO OWNER
3	REMOVE EXISTING 60A DISCONNECT.
4	REMOVE EXISTING 1" CONDUIT AND CONDUCTORS.
5	EXISTING 6X6X4 JUNCTION BOX

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NORTH ELECTRICAL DEMOLITION PLAN

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7/16/2025

PROJECT: 25023

DATE: 07/16/2025

SHEET E0.3

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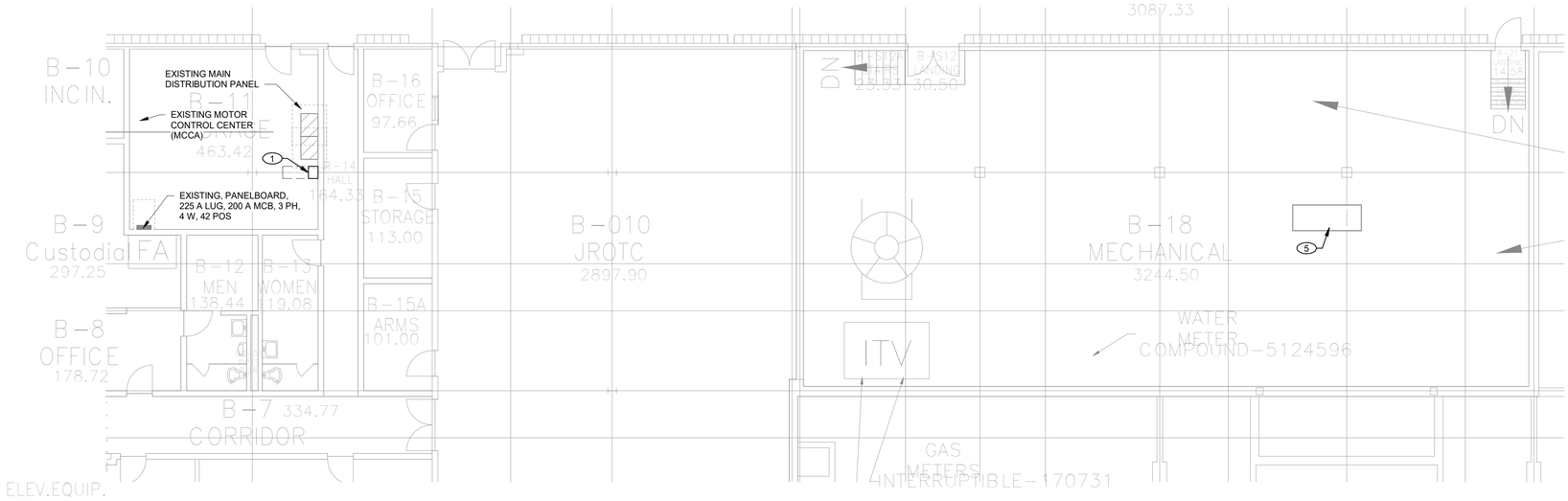
Autodesk Docs://25023 OPS North and Northwest Cooling Towers/25023-OPS-North-Northwest-Cooling-Towers_R24.rvt

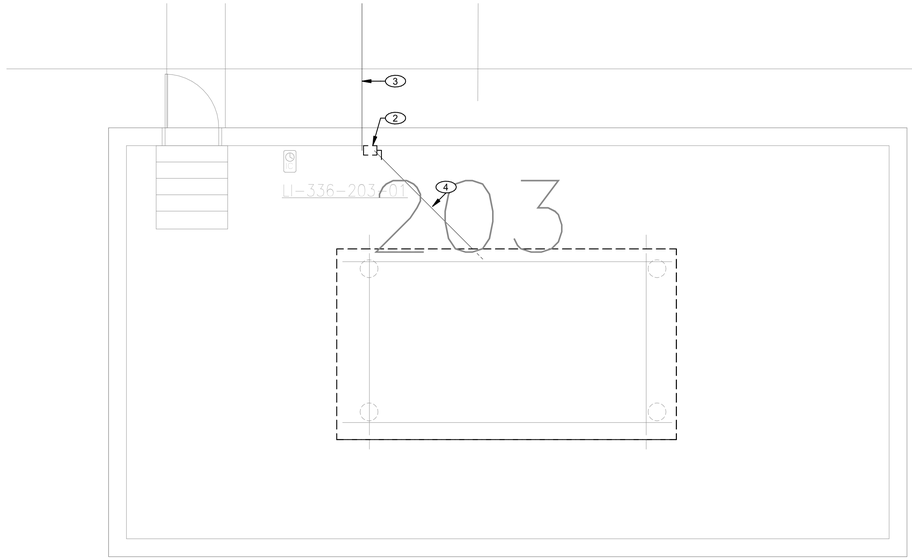


2 E0.4 NORTHWEST BASEMENT ELECTRICAL DEMOLITION PLAN

SCALE: 1/8" = 1'-0"

0' 2' 4' 8' 16' 24'

NORTH



1 E0.4 NORTHWEST ELECTRICAL DEMOLITION PLAN

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

0' 1' 2' 4' 6' 12'

NORTH

ELECTRICAL DEMOLITION NOTES:

A. SEE SHEET E0.0 FOR ELECTRICAL SYMBOLS LEGEND AND GENERAL ELECTRICAL DEMOLITION NOTES.

KEYNOTES	
1	EXISTING VFD'S TO BE REMOVED AND RETURNED TO OWNER
2	REMOVE EXISTING 60A DISCONNECT.
3	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
4	EXISTING 1 1/2" EMT CONDUIT FROM EXISTING DISCONNECT TO EXISTING COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND. REUSE EXISTING CONDUIT TO PROVIDE POWER TO NEW COOLING TOWER IF APPLICABLE.
5	EXISTING CHILLER TO REMAIN.

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

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NORTHWEST ELECTRICAL DEMOLITION PLAN

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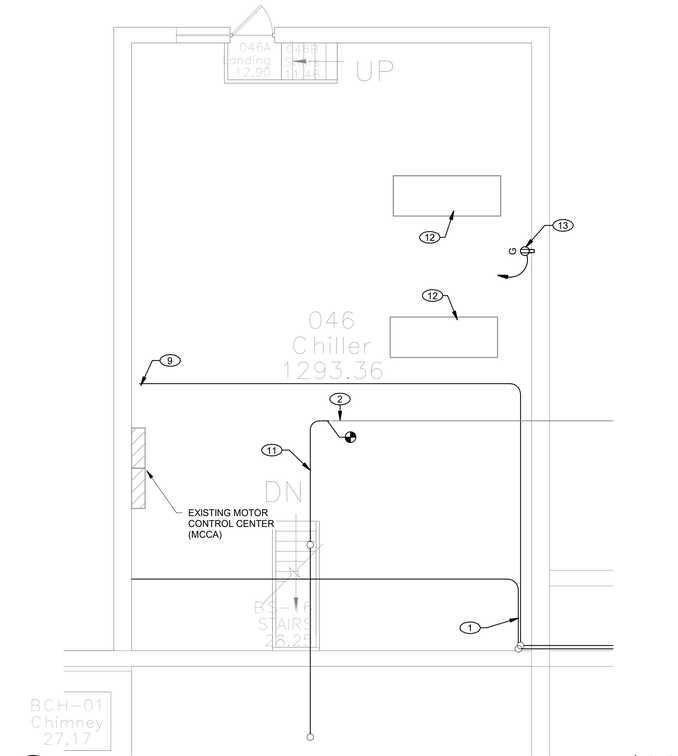
7/16/2025

PROJECT: 25023

DATE: 07/16/2025

SHEET E0.4

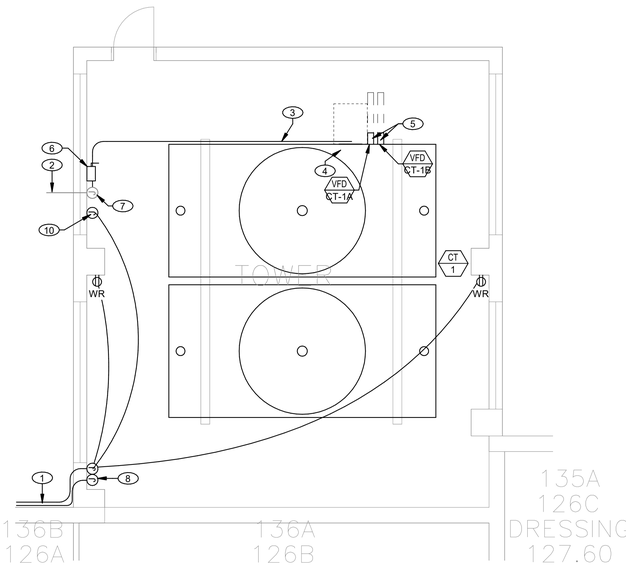


2 E1.1 NORTH BASEMENT ELECTRICAL PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH



1 E1.1 NORTH ELECTRICAL PLAN

SCALE: 3/16" = 1'-0"

0' 2' 4' 8' 16'

NORTH

ELECTRICAL POWER NOTES:

A. SEE SHEET E0.0 FOR ELECTRICAL SYMBOLS LEGEND AND GENERAL ELECTRICAL NOTES.
B. SEE MECHANICAL AND ELECTRICAL SCHEDULE ON M7.1 FOR ADDITIONAL INFORMATION ON MECHANICAL EQUIPMENT REQUIRING POWER.

KEYNOTES	
1	PROVIDE (2) 3/4" CONDUITS FOR 120 VOLT POWER AND CONTROL CIRCUITS FROM BASEMENT TO COOLING TOWER.
2	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
3	PROVIDE 1 1/2" CONDUIT WITH (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND FROM EXISTING J-BOX TO FACTORY PROVIDED AND INSTALLED PANEL.
4	FACTORY PROVIDED AND INSTALLED PANEL. VERIFY LOCATION. EXTEND 1" CONDUIT FROM PANEL TO VFD'S AND VFD'S TO FAN CONNECTIONS. EXTEND 1" CONDUIT FROM PANEL TO BASIN HEATERS.
5	VARIABLE FREQ DRIVE.
6	PROVIDE NEW NEMA 3R, 200A, 480V, 3P, NON-FUSED DISCONNECT. EXTEND CONDUIT FROM DISCONNECT TO TOWER SINGLE POINT CONNECTION PANEL.
7	EXISTING 6X6X4 JUNCTION BOX
8	PROVIDE J-BOX FOR CONNECTION OF COOLING TOWER CONTROL CIRCUIT.
9	TERMINATE CONDUIT AT CONTROL BOX LOCATION.
10	PROVIDE 120V JUNCTION BOX FOR CONNECTION OF HEAT TRACE FOR PIPING. COORDINATE WITH MECHANICAL.
11	EXTEND CONDUIT TO NEW SWITCHGEAR IN SUB BASEMENT. IN EXISTING SPARE BREAKER SPACE SET AT 200A.
12	EXISTING CHILLER TO REMAIN.
13	PROVIDE GFI RECEPTACLE FOR NEW SCALE FREE SYSTEM. COORDINATE LOCATION WITH SCALE FREE SYSTEM INSTALLING CONTRACTOR. CIRCUIT GFI TO NEAREST 120V NON-OVERLOADED CIRCUIT.

OPS NORTH & NORTHWEST COOLING TOWER REPLACEMENT

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7/16/2025

PROJECT: 25023
DATE: 07/16/2025

SHEET E1.1

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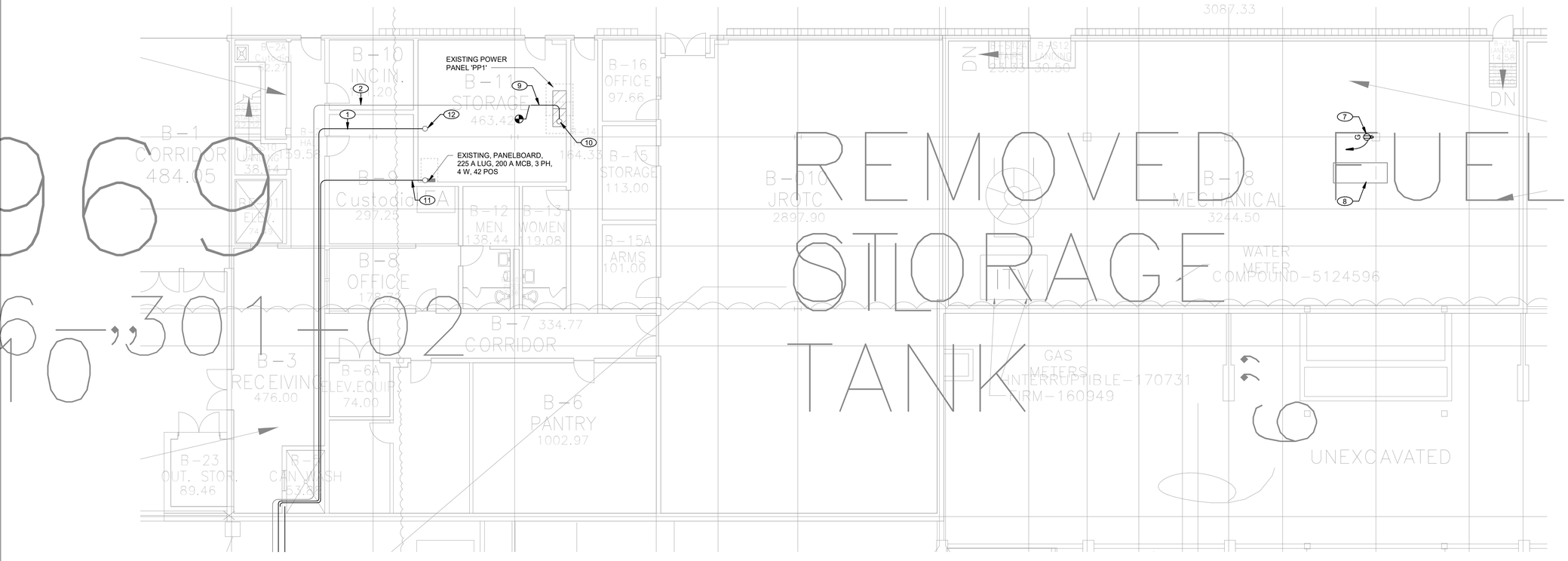
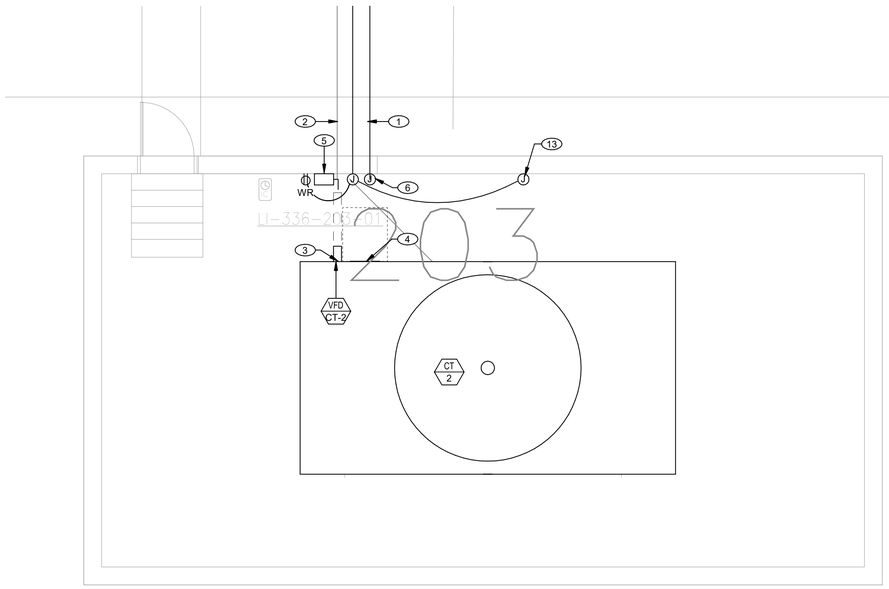


2 E1.2 NORTHWEST BASEMENT ELECTRICAL PLAN

SCALE: 1/8" = 1'-0"

0' 2' 4' 8' 16' 24'

NORTH



1 E1.2 NORTHWEST ELECTRICAL PLAN

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

0' 1' 2' 4' 6' 12'

NORTH

ELECTRICAL POWER NOTES:

A. SEE SHEET E0.0 FOR ELECTRICAL SYMBOLS LEGEND AND GENERAL ELECTRICAL NOTES.
B. SEE MECHANICAL AND ELECTRICAL SCHEDULE ON M7.1 FOR ADDITIONAL INFORMATION ON MECHANICAL EQUIPMENT REQUIRING POWER.

KEYNOTES	
1	PROVIDE (2) 3/4" CONDUITS FOR 120 VOLT POWER AND CONTROL CIRCUITS FROM BASEMENT TO COOLING TOWER.
2	EXISTING 1 1/2" EMT CONDUIT FROM BASEMENT TO COOLING TOWER LOCATION. REMOVE EXISTING CONDUCTORS AND REPLACE WITH NEW (3) #1/0 AWG, CU, THWN, (1) #6 AWG, CU, THWN, GRND.
3	VARIABLE FREQ DRIVE.
4	FACTORY PROVIDED AND INSTALLED PANEL. VERIFY LOCATION. EXTEND 1" CONDUIT FROM PANEL TO VFD'S AND VFD'S TO FAN CONNECTIONS. EXTEND 1" CONDUIT FROM PANEL TO BASIN HEATERS.
5	PROVIDE NEW NEMA 3R, 200A, 480V, 3P, NON-FUSED DISCONNECT. EXTEND CONDUIT FROM DISCONNECT TO TOWER SINGLE POINT CONNECTION PANEL.
6	PROVIDE J-BOX FOR CONNECTION OF COOLING TOWER CONTROL CIRCUIT.
7	PROVIDE GFI RECEPTACLE FOR NEW SCALE FREE SYSTEM. COORDINATE LOCATION WITH SCALE FREE SYSTEM INSTALLING CONTRACTOR. CIRCUIT GFI TO NEAREST 120V NON-OVERLOADED CIRCUIT.
8	EXISTING CHILLER TO REMAIN.
9	EXTEND CONDUIT TO POWER PANEL 'PP1' AND TERMINATE IN PANEL.
10	REPLACE EXISTING GE SPECTRA SERIES 100A FUSIBLE SWITCH UNIT WITH A NEW RETROFIT KIT DESIGNED TO REPLACE THE EXISTING SWITCHES. RETROFIT KIT TO BE RATED AT 150 AMP AND BE A TUNABLE BREAKER.
11	TERMINATE CONDUIT IN 208/120 PANEL WITH 20A SPARE.
12	TERMINATE CONDUIT AT CONTROL BOX LOCATION.
13	PROVIDE 120V JUNCTION BOX FOR CONNECTION OF HEAT TRACE FOR PIPING. COORDINATE WITH MECHANICAL.

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PROFESSIONAL MECHANICAL ENGINEER BRIAN D. HOWELL E-15785 STATE OF NEBRASKA

7/16/2025

PROJECT: 25023
DATE: 07/16/2025
SHEET E1.2