City of Dublin

DUBLIN COMMUNITY RECREATION CENTER GEOTHERMAL PROJECT

CITY OF DUBLIN, OHIO

BID AND CONTRACT DOCUMENTS

Prepared by:
Prater Engineering Associates

November 24, 2014

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END OF DOCUMENT

SECTION 1
BIDDING REQUIREMENTS

INVITATION TO BID

Sealed proposals will be received from invited bidders by:

City of Dublin, Ohio
Administrative Services – Facilities
6555 Shier Rings Road
Dublin, Ohio 43016

until **1:00 p.m.** local time on **December 23, 2014** at which time the sealed proposals will be opened by the **Facilities Manager**, for the following project:

Dublin Community Recreation Center Geothermal Project
5600 Post Road

For all labor, materials and equipment necessary for the construction and associated site work for the **Dublin Community Recreation Center Geothermal Project** as indicated within the plans and associated documents. A pre-bid meeting is planned for 10:00 a.m. on December 9, 2014 at the Dublin Community Recreation Center located at 5600 Post Road.
.

All work is to be included in the bid.

Service delivery shall be in accordance with contract documents**.**

The contract documents will be available for examination on November 25th during regular business hours until the date of bid opening at:

City of Dublin, Ohio
Administrative Services – Facilities
6555 Shier Rings Road
Dublin, Ohio 43016

And

F.W. Dodge
1175 Dublin Road
Columbus, Ohio 43215

Copies of the contract documents may be obtained upon request accompanied by a non refundable deposit in the amount of $30.00 for each set of contract documents. Checks shall be made payable to "City of Dublin, Ohio." Documents are also available online at http://dublinohiousa.gov/bids-and-requests-for-proposals/. When downloading bid documents from online you must register as a plan holder.

Prevailing Wages

APPLICABLE

Bidders shall comply with Chapter 4115 of the Ohio Revised Code (Wages and Hours on Public Works). Bidders are responsible for verifying that the most current wage rates are utilized in their bids. The successful bidder is also responsible for any changes in the prevailing wage rates or classifications throughout its performance of work on the Project.

Bids and Attached Documents

Bidders shall submit their bids on the form of proposal provided by the **Facilities Manager.**

Each proposal shall be submitted in its entirety in a sealed envelope addressed to:

Brian Ashford
Facilities Manager
City of Dublin, Ohio
Administrative Services - Facilities
6555 Shier Rings Road
Dublin, Ohio 43016

Each sealed envelope containing a proposal shall be plainly marked on the outside as – "Bid for:
Dublin Community Recreation Center Geothermal Project." The envelope shall bear the name and address of the bidder.

If forwarded by mail, the sealed envelope containing the proposal must be enclosed in another envelope and the outside of the envelope must be addressed to and marked:

Brian Ashford
Facilities Manager
City of Dublin, Ohio
Administrative Services - Facilities
6555 Shier Rings Road, Dublin, Ohio 43016

BID FOR: **Dublin Community Recreation Center Geothermal Project**

Bidders shall submit the following with their proposals:

1. Non-collusion Affidavit.
2. Bid/Performance Bond.
3. List of Subcontractors if applicable.
4. Delinquent Personal Property Tax Affidavit.
5. Affidavit of Authority (if Bidder is a corporation).
7. Experience Record/References.
8. Power of Attorney (if Bidder is an out-of-state corporation).

The City of Dublin, Ohio reserves the right to reject any and all proposals and to waive any informalities or irregularities in the proposals.

Bidders may address inquiries to:

Brian Ashford
Facilities Manager
City of Dublin, Ohio
Administrative Services - Facilities
6555 Shier Rings Road
Dublin, Ohio 43016
Telephone: (614) 410-4790
Fax: (614)761-6512
The hearing impaired may
call V/TDD at (614) 410-4700

By order of the City Council of the City of Dublin, Ohio.
CITY OF DUBLIN, OHIO
Marsha I. Grigsby
City Manager

INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

Immediately notify **Prater Engineering.** upon finding discrepancies or omissions in the bidding documents.

Direct inquiries and questions to:

John B. Kerr
PROJECT MANAGER
Prater Engineering
6130 Wilcox Road
Dublin, Ohio 43216

Office: 614-766-4896
jkerr@praterengr.com

1. Submit written request for clarification, correction or interpretation to the City not less than 7 days before the date for receipt of bids.

2. Modifications to the bidding documents will be issued as Addenda to the specifications and will become a part of the Contract.

3. No bidder shall rely on oral modifications or any other method of clarification, correction or interpretation of the bidding documents. Only modifications set forth in an Addendum will be binding.

SECTION 2
BIDDING FORMS

City of Dublin
Dublin Community Recreation Center Geothermal Project

PROPOSAL

_____ (the "Bidder") submits this Proposal having read and examined the contract documents, including but not limited to the Invitation to Bid; the City of Dublin, Ohio

All bids will be based upon elements indicated within the Drawings and Specifications. All changes to actual length, either additions or subtractions, will be through Change Order(s) using unit price(s) provided by contractor on proposal form.

Addendum Number	Date of Receipt
_____	_____
_____	_____

The Bidder proposes to provide the above named **Dublin Community Recreation Center Geothermal Project** in accordance with the contract documents for the following sum:

Total Base Bid (in figures): $ _____

Total Base Bid (in words): $ _____

In the event of a discrepancy between the amount of the total bid as written in figures and in words, the amount written in words shall govern.

Unless otherwise specified in the Bid Document the amount of the total bid is based on the unit prices or lump sum set forth in the Bid Schedule attached hereto and incorporated herein. The Bidder understands and agrees that delivery under the Agreement for **Dublin Community Recreation Center Geothermal Project** shall be complete within **one hundred twenty (120) consecutive calendar days,** or as specified in bid documents unless an extension of time is granted by the **Facilities Manager**.

Upon failure to have all work completed within the project time, the City of Dublin, Ohio shall be entitled to retain or recover from the Bidder, as liquidated damages, and not as a penalty, the amounts set forth in the following table for each and every calendar day until completion. The right of the City of Dublin, Ohio to recover liquidated damages shall not substitute for any recovery for additional costs in the event the Bidder fails to complete the Agreement for construction according to the contract documents.

Liquidated Damages:

Contract Amount	Dollars Per Day
$0-25,000	$ 100.00
25,001-50,000	150.00
50,001-100,000	200.00
100,001-500,000	300.00
500,001-1,000,000	500.00
1,000,001-2,000,000	750.00
2,000,001-5,000,000	1,000.00
5,000,001-10,000,000	1,500.00
Over $10,000,001	2,000.00

REPRESENTATIONS OF THE BIDDER

The Bidder represents the following:

1. The Bidder has read and understands the contract documents and understands that it must comply with all requirements of the contract documents, regardless of whether the Bidder has actual knowledge of the requirements and regardless of any statement or omission made by the Bidder which might indicate a contrary intention.

2. The Proposal is based upon the items specified by the contract documents.

3. The Bidder has visited the site, become familiar with local conditions, and has correlated personal observations about the requirements of the contract documents. The Bidder has no outstanding questions regarding the interpretation of the contract documents.
4. The Bidder has submitted the following in connection with this Proposal and the information contained therein is complete and accurate:

    a. Non-collusion Affidavit.

    b. Bid/Performance Bond.

    c. List of Subcontractors.

    d. Delinquent Personal Property Tax Affidavit.

    e. Affidavit of Authority (if Bidder is a corporation).

g. Experience Record/References.

h. Power of Attorney (if Bidder is an out-of-state corporation).

6. The Bidder understands that the Agreement for the **Dublin Community Recreation Center Geothermal Project** is subject to all of the provisions, duties, obligations, remedies and penalties of the Ohio Revised Code.

7. Within ten (10) business days from the date of receipt the Notice of Intent to Award, the Bidder understands that it must enter into and execute an Agreement for the **Dublin Community Recreation Center Geothermal Project** with the City of Dublin, Ohio if awarded on the basis of this Proposal. If the Bidder does not execute an Agreement for the **Dublin Community Recreation Center Geothermal Project** for any reason, the Bidder and the Bidder's surety shall be liable to the City of Dublin, Ohio as provided in Ohio Revised Code Section 153.54(G).

8. Within ten (10) business days of the date of receipt of the Notice of Intent to Award, the Bidder understands that it must submit the following:

a. Performance Bond.
b. Certificate of Insurance and a copy of Additional Insured Endorsement.
c. Certificate of Compliance with Affirmative Action.

9. The Bidder understands that it must furnish any other information requested by the **Brian Ashford, Facilities Manager**.

The Bidder hereby signs this Proposal on the ___ day of _____, **2014**.

If Bidder is an individual, complete the following:

Signature: _____

Print Name: _____

Name of Business: _____
(if different than above)

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

If Bidder is a partnership, complete the following:

Name of Partnership: _____

By: _____
(Signature)

Print Name: _____

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

Names and Addresses of all general partners:

_____

_____

_____

If Bidder is a joint venture, complete the following:

Name of Joint Venture: _____

By: _____
(Signature)

Print Name: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

Complete the following for each firm represented by the joint venture:

1. Name:_____

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

2. Name: _____

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

If Bidder is a corporation, complete the following:

Name of Corporation: _____

By: _____
(Signature)

Print Name: _____

Title: _____

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

State of Incorporation: _____

Names and addresses of Corporate Officers:

_____

_____

_____

If Bidder is an entity other than those described above, complete the following:

Name of Bidder:

By: _____
(Signature)

Print Name: _____

Title: _____

Federal Identification Number: _____

Address: _____

_____

Telephone: ( ) _____

Fax: ( ) _____

Type of Business Entity: _____

Names and addresses of all Principals:

_____

_____

_____

_____

_____

City of Dublin
Dublin Community Recreation Center Geothermal Project

BID/PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned (the "Principal") and (the "Surety") are herby held and firmly bound unto the City of Dublin, Ohio ("Dublin") as obligee in the penal sum of the dollar amount of the bid submitted by the Principal to Dublin on, _____2013 to undertake the project known as:

Dublin Community Recreation Center Geothermal Project

The penal sum referred to herein shall be the dollar amount of the Principal's bid to Dublin, incorporating any additive or deductive alternate proposals made by the Principal on the date referred to above to Dublin, which are accepted by Dublin. In no case shall the penal sum exceed the amount of _____ dollars ($). (If the foregoing blank is not filled in, the penal sum will be the full amount of the Principal's bid, including alternates. Alternatively, if the blank is filled in, the amount stated must not be less than the full amount of the bid including alternates, in dollars and cents. A percentage is not acceptable.)

For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that whereas the above-named Principal has submitted a bid for the **Dublin Community Recreation Center Geothermal Project.**

NOW, THEREFORE, if Dublin accepts the bid of the Principal and the Principal fails to enter into a proper contract in accordance with the bid, plans, details, specifications, and bills of material; and in the event the Principal pays to Dublin the difference not to exceed ten percent of the penalty hereof between the amount specified in the bid and such larger amount for which Dublin may in good faith contract with the next lowest bidder to perform the work covered by the bid, or in the event Dublin does not award the contract to the next lowest bidder and resubmits the project for bidding, the Principal will pay Dublin the difference not to exceed ten percent of the penalty hereof between the amount specified in the bid, or the costs, in connection with the resubmission, of printing new contract documents, required advertising and printing and mailing notices to prospective bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect; if Dublin accepts the bid of the Principal and the Principal within ten days after the awarding of the contract, enters into a proper contract in accordance with the bid, plans, details specifications, and bills of material, which said contract is made a part of this bond the same as though set forth herein.

City of Dublin
Dublin Community Recreation Center Geothermal Project

NOW ALSO, if the Principal shall well and faithfully do and perform the things agreed by Principal to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, material men, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any material man or laborer having a just claim, as well as for Dublin herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The Surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of the Surety on the Surety's bond, and the Surety does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the plans or specifications.

Signed this _____ day of _____, **2014**.

PRINCIPAL:

_____

By: _____
(Signature)

Print Name: _____

Title: _____

Address:

_____

_____

Telephone: ( ) _____

SURETY:

_____

By: _____
(Signature)

Print Name: _____

Title: _____

Address:

_____

_____

Telephone: ( ) _____

SURETY AGENT:

_____

By: _____
(Signature)

Print Name: _____

Title: _____

Address:

_____

_____

Telephone: ( ) _____

City of Dublin
Dublin Community Recreation Center Geothermal Project

DELINQUENT PERSONAL PROPERTY TAX AFFIDAVIT

STATE OF _____
COUNTY OF _____, SS:

I, _____ (Affiant), _____ (Title) of _____ (the "Bidder"), after being cautioned and sworn, represent to the City of Dublin, Ohio, the following: (check the appropriate statement)

At the time the Proposal was submitted, the Bidder was not charged with delinquent personal property taxes on the General Tax Lists of Personal Property of a county in which the City of Dublin, Ohio has territory (Franklin, Delaware, and Union Counties).

OR

At the time the Proposal was submitted, the Bidder was charged with delinquent personal property taxes on the General Tax Lists of Personal Property of a county in which the City of Dublin, Ohio has territory (Franklin, Delaware, and Union Counties) and that the amounts of such due and unpaid delinquent taxes, including due and unpaid penalties and interest, are set forth below:

Taxes:	Penalties and Interest:	Counties:
$_____	$_____	_____
$_____	$_____	_____
$_____	$_____	_____

_____
(Signature of Affiant)

_____
(Print Name)

Sworn to and subscribed before me this ____ day of _____ **2014**.

_____
Notary Public

City of Dublin
Dublin Community Recreation Center Geothermal Project

NONCOLLUSION AFFIDAVIT

STATE OF _____
COUNTY OF _____, SS:

I, _____ (Affiant), _____ (Title) of _____ (the "Bidder"), after being cautioned and sworn, represent to the City of Dublin, Ohio the following:

1. The bid price contained in the Bidder's Proposal for the Project has been arrived at independently without collusion, consultation, communication, or agreement for the purpose of restricting competition as to any matter relating to such bid price with any other bidder or third party.

2 Unless otherwise required by law, neither the bid price nor the Proposal has been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to the bid opening, directly or indirectly, to any other bidder or to any third party that would have any interest in the bid price.

3 No attempt has been made or will be made by the Bidder to induce any other individual, partnership, or corporation to submit or not to submit a bid for the purpose of restricting competition.

_____
(Signature of Affiant)

_____
(Print Name)

Sworn to and subscribed before me this ___ day of _____, 2014

_____
Notary Public

City of Dublin
Dublin Community Recreation Center Geothermal Project

AFFIDAVIT OF AUTHORITY

STATE OF _____
COUNTY OF _____, SS:

I, _____ (Affiant), after being cautioned and sworn, state the following:

1. I am the Secretary of _____ (the "Company"), a corporation organized and existing under the laws of the State of _____.

2. I am familiar with the records of the Company.

3. _____ (name of officer) is authorized to sign the Proposal and to execute a contract on behalf of the Company for the above-referenced project.

_____
(Signature of Affiant)

_____
(Print Name)

Sworn to and subscribed before me this _____ day of _____, **2014**

_____
Notary Public

LIST OF SUBCONTRACTORS
Applicable __X__

NOTE: The bidder must perform at least 30% of the total contract cost with its own forces.

Complete the following information for all subcontractors, which will be employed on the Project.

1. Name of Subcontractor:_____

Federal Identification Number: _____

Address: _____

_____

Type of Work Subcontractor to Provide:_____

Approximate Percentage of the Contract Cost to be Performed by Subcontractor:_____

Experience Record: _____

2. Name of Subcontractor: _____

Federal Identification Number: _____

Address: _____

_____

Type of Work Subcontractor to Provide: _____

Approximate Percentage of the Contract Cost to be performed by Subcontractor: _____

Experience Record: _____

3. Name of Subcontractor:
_____

Federal Identification Number: _____

Address: _____
_____

Type of Work Subcontractor to Provide:
_____

Approximate Percentage of the Contract
Cost to be performed by Subcontractor: _____

Experience Record: _____

4. Name of Subcontractor:
_____

Federal Identification Number: _____

Address:_____

_____

Type of Work Subcontractor to Provide:
_____

Approximate Percentage of the Contract
Cost to be performed by Subcontractor: _____

Experience Record: _____

EXPERIENCE RECORD/REFERENCES

NOTE: Bids from contractors inexperienced in this particular type of work will not be considered.

Complete the following information with respect to previous purchasers.

1. Name of Person to Contact for Reference:
_____

Address: _____

_____

Phone: ( )_____

2. Name of Person to Contact for Reference:
_____

Address: _____

_____
Phone: ( )_____

3. Name of Person to Contact for Reference:
_____

Address: _____

_____

Phone: ( )_____

SECTION 3
CONTRACT FORMS
(TO BE EXECUTED WITH THE SELECTED BIDDER)

NOTICE OF INTENT TO AWARD

To: _____

_____

_____

You are hereby notified that the City of Dublin, Ohio has accepted the Proposal submitted by you on_____, **2014** in response to the Invitation to Bid for the above-referenced project.

Within ten (10) business days from the date of receipt of this Notice of Award, you are required to:

1. Execute an Agreement for Construction.
2. Submit a Performance Bond.
3. Submit a Certificate of Insurance and a copy of an Additional Insured Endorsement.
4. Submit an Affirmative Action Certificate of Compliance.

If you fail to execute the Agreement for construction or provide the required submittals within ten (10) business days from the date of receipt of this Notice of Intent to Award, you or your surety shall be liable to the City of Dublin, Ohio as provided in Ohio Revised Code Section 153.54(G) and the City of Dublin, Ohio may award the contract to the next lowest and best bidder.

You are required to prepare and submit a progress schedule prior to the pre-construction conference to be held on _____ Not Applicable _____

Return an acknowledged copy of this Notice of Intent to Award to:

Brian Ashford, Facilities Manager
Facilities Department
6555 Shier Rings Road
Dublin, Ohio 43016CITY OF DUBLIN, OHIO

Date: _____ By:_____
Brian Ashford, Facilities Manager

RECEIPT OF NOTICE OF INTENT TO AWARD

Receipt of this Notice of Intent to Award is hereby acknowledged this _____ day of _____, **20__.**

Company Name: _____

Signature: _____

Print Name: _____

Title: _____

Contract No: _____

STANDARD AGREEMENT
CITY OF DUBLIN, OHIO

This Agreement is entered into this _____ day of _____, 20____, by and between the City of Dublin, Ohio (**DUBLIN**), the Owner, located at 5200 Emerald Parkway, Dublin, Ohio 43017, and the

SERVICE PROVIDER

_____

_____

_____

_____

FOR THE FOLLOWING:
City of Dublin
Dublin Community Recreation Center Geothermal Project
5600 Post Road

The **ARCHITECTS** of the Project are

John B. Kerr, P.E.
6130 Wilcox Road
Dublin, OH 43016
d: 614-766-4896
jkerr@praterengr.com

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES. CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS EXECUTION, COMPLETION AND MODIFICATION

CONTRACT DOCUMENTS

This Agreement is for performance of a portion of the Work for the Project identified above. All Work by Service Provider shall be performed in accordance with the Contract Documents. The Contract Documents comprise of and include this Agreement, General and Supplemental Conditions, Plans and Specifications, Project Manuals and all amendments thereto. These Contract Documents are hereby specifically incorporated herein as part of this Agreement and shall govern the Service Provider for his portion of the Work related to the Project.

Service Provider shall furnish all materials, supplies, equipment, and other items proper or necessary to perform and complete the Work, including specifically providing all supervision and labor required for the completion of the Work in accordance with the Contract Documents.

Service Provider agrees and acknowledges that it has evaluated and is satisfied with the conditions and limitations under which the Work is to be performed, including, without limitation (i) the location, condition, layout and nature of the Project site and surrounding areas; (ii) generally prevailing weather and climatic conditions; (iii) anticipated labor supply and costs; (iv) availability and cost of materials, tools and equipment; and (v) other similar issues. Service Provider further represents and warrants that it is familiar with the entire Scope of its Work and that the Contract Price includes all of its Work that is specifically included in the Contract Documents or which is reasonably inferable from the Contract Documents.

In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes, and ordinances, Service Provider shall (i) provide the better quality or greater quantity of Work or (ii) comply with the more stringent requirement.

CONTRACT PRICE

As full compensation for performance of the Agreement, Dublin agrees to pay Service Provider in current funds the Contract Price for the satisfactory performance of the Work, in the manner described below, subject to all applicable provisions of the Agreement (check appropriate box):

☐ the firm fixed price of _____ Dollars ($_____) subject to additions and deductions as provided for in the Contract Documents; and/or

1. unit prices in accordance with the attached Schedule of Unit Prices and estimated quantities, which is incorporated herein by reference and identified as Schedule; and/or

2. time and material rates and prices in accordance with the attached Schedule of Labor and Material Costs which is incorporated herein by reference and identified as Schedule

The firm fixed-price, unit prices and/or time and material rates and prices are hereinafter referred to as the "Contract Price."

SURETY BONDING

BONDS

Service Provider shall, if required, furnish to Dublin appropriate surety bonds to secure performance of the Work and to satisfy all Service Provider's payment obligations under the Agreement. The surety bond shall provide that the terms of the Agreement and Contract Documents are incorporated by reference therein. Any bond provided by Service Provider pursuant to this provision is hereby deemed to so incorporate the Contract Documents and it is understood that the surety is accepting each and every responsibility and obligation which Service Provider has assumed toward Dublin under this Agreement and the Contract Documents, including but not limited to liability for indemnity, attorneys' fees and delay damages.

Bond: **X** Required ☐ Not Required

If a performance or payment bond, or both, are required of the Service Provider under this Agreement, then said bonds shall be in the full amount of the Contract Price, unless otherwise specified herein.

The cost of the bond, if required, is included in the Contract Price.

In the event Service Provider shall fail to provide the required bonds within seven days after date of signature of this Agreement by both Parties, Dublin after giving the Service Provider written notice and opportunity to cure this may terminate this Agreement and enter into a contract for the balance of the Work with another contractor. The Service Provider shall pay all Dublin's costs and expenses incurred by Dublin as a result of said termination.

PERFORMANCE OF WORK

TIME IS OF THE ESSENCE

It is expressly understood and agreed by and between the Parties that time is of the essence regarding completion of the Work by Service Provider. Service Provider shall undertake all activities necessary for the performance of its Work immediately upon receipt of a letter of intent or notification of the award of this Agreement and shall commence work hereunder so that the entire Project may be completed in accordance with the Project Schedule. Service Provider shall perform, coordinate and schedule its Work so as not to cause any delay or disruption to the Project Schedule, the work of other entities on this Project or the completion date of the Project.

Service Provider acknowledges and agrees that Dublin will incur additional costs, damages, liabilities, lost profits or losses related to loss of use if this Project is not completed in accordance with any milestone or interim dates/deadlines or the substantial or final completion dates on the Project Schedule. As a result, Service Provider shall be liable for and shall reimburse Dublin for any such additional costs, damages, liabilities, lost profits or losses related to loss of use for its failure to meet all milestone, interim, substantial or final completion dates in accordance with the Project Schedule.

RELATIONSHIP OF THE PARTIES

Service Provider accepts the relationship of trust and confidence established by this Agreement to exercise its skill and judgment to further Dublin's interests, and to perform the Work in an expeditious and economical manner consistent with Dublin's interests. Nothing in this Agreement shall be construed to constitute the relationship between Service Provider and Dublin as a partnership, association, or joint venture.

Service Provider shall perform its Work under the general direction of Dublin (and/or Dublin's representative, construction manager, architect, or other duly authorized individual/entity) and in accordance with this Agreement and as reasonably inferable from the Contract Documents as being necessary to produce the intended results as specified hereafter.

PROJECT SCHEDULE

Service Provider agrees to perform its work in accordance with the sequence and schedule for this Project, and with any updates thereto (referred to in this Agreement as the "Project Schedule"). By agreeing to perform its Work in accordance with the Project Schedule, Service Provider has included reasonable allowances for out of sequence work, and weather and unusual or unforeseen delays. If requested by Dublin, Service Provider shall participate and cooperate in the development of the Project Schedule and any revisions thereto.

Service Provider shall continuously monitor the Project Schedule so as to be fully familiar with the timing, phasing and sequence of operations of Service Provider's Work

and the other work being performed on the Project. Service Provider shall coordinate its Work with all other work on the Project to avoid conflict or interference with such other work.

If Dublin determines that Service Provider's Work has failed to meet the Project Schedule or any update thereof, Service Provider shall within seventy-two (72) hours of its receipt of written notice from Dublin prepare and submit a recovery schedule relating to its activities. Service Provider agrees that it shall at its sole cost and expense take such measures as are necessary, including adding manpower and/or equipment and/or working overtime to accelerate its activities to conform to the Project Schedule or any update thereto. Should Service Provider fail to undertake such measures Dublin shall have the right to supplement Service Provider's forces and/or equipment and back-charge Service Provider for the costs so incurred, together with a markup of ten percent (10%) for overhead and profit.

PERFORMANCE

Service Provider shall use its best care, skill, and diligence in supervising, directing and performing, the Work. Service Provider shall have sole responsibility for the performance of the Work, including the methods, techniques and means for completing all portions of the Work. Service Provider has the responsibility to ensure that all material suppliers and subcontractors adhere to the Contract Documents, and that they order materials in time, taking into account the current market regarding both pricing and delivery conditions.

EXTRAORDINARY MEASURES BY DUBLIN

If the performance of the Work, as of a milestone or interim date/deadline on the Project Schedule, has not progressed or reached the level of completion required by the Contract Documents, Dublin shall have the right to order Service Provider to take corrective measures necessary to expedite the progress of the Work, including, without limitation, (i) working additional shifts or overtime, (ii) supplying additional manpower, equipment, and facilities, and (iii) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. Dublin's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the Project Schedule. Service Provider shall not be entitled to an adjustment in the Contract Price in connection with Extraordinary Measures required by Dublin.

INTERPRETATION OF AGREEMENT

INCONSISTENCIES AND OMISSIONS

Should inconsistencies or omissions appear in the Contract Documents, it shall be the duty of Service Provider to so notify Dublin in writing within three (3) working days of

Service Provider's discovery thereof. Upon receipt of said notice, Dublin shall instruct the Service Provider as to the measures to be taken and Service Provider shall comply with Dublin's instructions. If Service Provider performs work knowing it to be contrary to any applicable laws, statues, ordinances, building codes, rules or regulations without notice to Dublin and advance approval by appropriate authorities, then Service Provider shall assume full responsibility for such work and shall bear all associated costs, charges, fees and expenses necessarily incurred to remedy the situation.

LAW AND EFFECT

The performance of this Agreement and all of its terms and conditions shall be interpreted and governed by the laws of the State of Ohio, unless otherwise noted herein.

SEVERABILITY

The partial or complete invalidity of anyone or more provisions of this Agreement shall not affect the validity or continuing force and effect of any other provision.

ENTIRE AGREEMENT

This Agreement is solely for the benefit of the signatories hereto and represents the entire and integrated agreement between the Parties hereto and, unless specifically referenced herein, supersedes any prior negotiations, representations, or agreements, either written or oral.

DUBLIN'S OBLIGATIONS

FINANCING INFORMATION Upon written request from Service Provider, Dublin agrees to furnish reasonable evidence that financial arrangements have been made or otherwise exist to fulfill Dublin's payment obligations under the Agreement.

PROJECT FEES Except for permits and fees, which are the responsibility of Service Provider, Dublin agrees to secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

TIMELY COMMUNICATIONS Dublin, with reasonable promptness, shall transmit all submittals, transmittals, and written approvals relating to the Work. Any other information or services relevant to service Provider's performance of the Work under Dublin's control shall be furnished by Dublin after receipt from Service Provider of a written request for such information or services.

SERVICE PROVIDER'S OBLIGATIONS

RESPONSIBILITIES Service Provider shall furnish all of the labor, materials, equipment, and services, including, but not limited to, competent supervision, shop drawings, samples, tools, and equipment as may be necessary for the proper performance of the Work in accordance with and as reasonably inferable from the Contract Documents.

SUBCONTRACTING Service Provider shall provide to Dublin written notice that it intends to subcontract any of the Work covered by the scope of the Contract Documents to a third party. Dublin shall have the right to approve any and all such subcontracts and Service Provider shall not allow any work to be performed by any subcontractor that has not been approved in writing by Dublin. Service Provider agrees that it shall not be entitled to any additional compensation in the event that Dublin does not approve a proposed subcontractor. Service Provider further agrees to incorporate the terms and conditions of this Agreement into every subcontract.

In the event that Service Provider has work performed by a subcontractor who has not been approved by Dublin, Dublin shall have the right to terminate this Agreement or supplement Service Provider's Work as necessary to have the same completed in accordance with the Contract Documents. Any and all costs incurred by Dublin as a result of such action shall be the responsibility of Service Provider and Dublin may back-charge Service Provider therefore.

SHOP DRAWINGS SAMPLES, PRODUCT DATA AND MANUFACTURERS' LITERATURE

To the extent applicable or required, Service Provider shall promptly submit to Dublin for approval all shop drawings, samples, product data, manufacturers' literature and similar submittals as required by the Contract Documents or as required herein. Service Provider shall prepare and deliver its submittals to Dublin in such time and sequence so as not to delay the Project. The approval of any Service Provider submittal shall not be deemed to authorize deviations, substitutions or changes in the requirements of the Contract Documents unless express written approval is obtained from Dublin authorizing such deviation, substitution or change.

COORDINATION AND COOPERATION

Service Provider shall:

(a) cooperate with Dublin and all others whose work may interfere or interface with the Work;

(b) before proceeding with the Work under this Agreement, accurately check all previous and surrounding work done by other entities, determine its correctness, specifically note and immediately advise Dublin of any interference or discrepancies with the Work. Failure of Service Provider to detect and report discrepancies shall relieve Dublin of any and all Service Provider claims to recover cost, expense or damage resulting there from; and

(c) participate in the preparation of coordination drawings and work schedules involving the Work, to the extent required or requested by Dublin.

AUTHORIZED REPRESENTATIVE

Unless otherwise stated in writing by Dublin, Service Provider shall have a competent foreman, superintendent, or representative, satisfactory to Dublin, on the Project at all times with authority to act on behalf of Service Provider with respect to the work and for the purpose of receiving notices, orders and instructions. Service Provider shall identify the person or persons so authorized to act on its behalf, in writing, before commencing work on the Project. All decisions, agreements or representations made by Service Provider's designated representative for this Project, whether oral or written, shall be binding on Service Provider.

TESTS AND INSPECTIONS

Service Provider shall schedule all required tests, approvals and inspections of the Work or portions thereof at appropriate times so as not to delay the progress of the Work or the Project. Service Provider shall bear all expenses associated with tests, inspections and approvals required of the Service Provider by the Contract Documents, unless otherwise agreed to.

WORKMANSHIP

Every part of the Work shall be executed in accordance with the Contract Documents in a workmanlike and professional manner. All materials used in the Work shall be furnished in sufficient quantities to facilitate the proper and expeditious execution of the Work, and shall be new.

MATERIALS FURNISHED BY OTHERS

In the event the scope of the Work includes installation of materials or equipment furnished by others, it shall be the responsibility of Service Provider to examine those items, store and install the items, unless otherwise provided for in the Contract Documents, with such skill and care as to ensure a satisfactory and proper installation. Loss or damage due to acts of Service Provider shall be deducted from any amounts due or to become due Service Provider under this Agreement.

SUBSTITUTIONS

No substitutions shall be made in the Work unless permitted in the Contract Documents and then only upon the Service Provider first receiving all approvals required under the Contract Documents for substitutions.

WARRANTY

Service Provider warrants and guarantees that its Work conforms in all respects to the Contract Documents and that it is free from defects in material and/or workmanship. Service Provider hereby warrants and guarantees its work to be free of defects in material or workmanship for a period of one year from the date of substantial completion, or such longer period as may be required by the Contract Documents or provided by any manufacturer's warranty applicable thereto. Service Provider further agrees to furnish any special warranties required by the Contract Documents relating to its Work prior to and as a condition of final payment. Service Provider agrees to perform any remedial or corrective work necessary to satisfy its warranty obligations without cost to Dublin.

UNCOVERING/CORRECTION OF WORK

If directed in writing by Dublin, Service Provider must uncover any portion of the Work, which has been covered by the Service Provider in violation of the Contract Documents or contrary to a directive issued by Dublin. Upon receipt of a written directive from Dublin, Service Provider shall uncover such Work for Dublin's inspection and then

restore the uncovered Work to its original condition at the Service Provider's time and expense.

Dublin may direct Service Provider to uncover portions of the Work for inspection by Dublin at any time. Service Provider is required to uncover such Work whether or not Dublin had requested to inspect the Work prior to it being covered. This Agreement shall be adjusted by Change Order for the cost and time of uncovering and restoring any Work which is uncovered for inspection and proves to be installed in accordance with the Contract Documents, provided Dublin had not previously instructed the Service Provider to leave the Work uncovered. If Service Provider uncovers Work pursuant to a directive issued by Dublin, and such Work upon inspection does not comply with the Contract Documents, then Service Provider shall be responsible for all costs and time of uncovering, correcting and restoring the Work so as to make it conform to the Contract Documents.

Service Provider is required to correct in a timely fashion any Work rejected by Dublin for failing to comply with the Contract Documents whether observed prior to the commencement of the warranty period(s) or during the warranty period(s).

Service Provider shall correct at its own cost and time and bear the expense of additional services for any nonconforming Work for which it is responsible.

CLEANUP

Service Provider shall at all times: (a) keep the Project and premises free from all rubbish and debris resulting from the Work; (b) broom clean each of its work areas prior to discontinuing work each day; and (c) clean up to the satisfaction of Dublin, including, but not limited to, dirt, grease, machine marks, etc., from walks, ceilings, floors, fixtures, etc. deposited or placed by or resulting from its Work.

If Service Provider fails to immediately commence compliance with cleanup duties within twenty-four (24) hours after written notification from Dublin of non-compliance, Dublin may implement appropriate cleanup measures without further notice and deduct the cost thereof from any amounts due or to become due to Service Provider under this Agreement.

SAFETY OF PERSONS AND PROPERTY

Service Provider is responsible for the health and safety of its employees, agents, subcontractors, and other persons on and adjacent to the Project site. Service Provider, however, shall take all necessary and prudent safety precautions with respect to its Work and shall comply with all safety programs and measures, and with all applicable laws, ordinances, rules, regulations and orders of any public authority for the safety of persons or property, including, but not limited to, OSHA. Service Provider shall also coordinate work activities with Dublin, other contractors or entities, or any other parties involved with this Project to reduce the risk of an accident or injury occurring.

Service Provider shall protect any of its work and materials susceptible to damage from moisture or hosting of mold at all times. Service Provider agrees to indemnify, hold harmless and defend Dublin from any and all claims, losses, costs and expenses (including, but not limited to, all attorneys’ and consultants’ fees) relating to or arising from mold resulting from Service Provider's Work.

INSURANCE
SERVICE PROVIDER'S INSURANCE

Prior to start of the Work, Service Provider shall procure and maintain in full force and effect Workers' Compensation Insurance, Employer's Liability Insurance, Comprehensive or Commercial General Liability Insurance on an occurrence basis, and any additional insurance required of Service Provider. Service Provider shall deliver all certificates of insurance to Dublin, or upon request, copies of the actual insurance policies. All liability insurance policies described above shall be written on a comprehensive form and shall conform to the laws of the State of Ohio. Before any of the Service Provider's employees perform any work on the Project, Service Provider shall furnish Dublin with the Insurance Company's certificate that such coverage has been provided and each certificate shall contain the required limits. Dublin shall be specifically named and included as an additional insured party under all coverage required by this Agreement

and coverage for such additional insured shall also be amended to include a waiver of subrogation and primary and noncontributing endorsements in favor of the additional insured.

The types of insurance, and minimum amount of limits, required hereunder are:

(A) Workers' Compensation Insurance coverage: statutory requirements in the State of Ohio.

(B) Employers Liability Insurance with limits of not less than $1,000,000 to anyone person: USL&H; FELA; Jones Act; and, Continental Shelf Act Endorsements, if applicable.

(C) Commercial General Liability Insurance, written on an occurrence form:

- ☐ Standard Limits
- ☐ Excess Liability Policy, if applicable: $____,000,000.
- ☐ Professional Liability, if applicable, $1,000,000 Each Occurrence, with not less than a Five Year Completed Operations period if claims-made coverage.
- ☐ Other policies.

NUMBER OF POLICIES

Commercial General Liability insurance and other liability insurance may be arranged under a single policy for the full limits required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy. The Umbrella Liability coverage must be as broad or broader than the Primary Insurance Policies.

PROPERTY INSURANCE

Service Provider is responsible to provide insurance coverage for tools, equipment or personal belongings that are owned or leased by the Service Provider or its employees at Service Provider’s own expense. Service Provider accepts and shall bear the risk of loss for its property, material, or equipment, which is stored on-site and off-site.

SUBROGATION

Service Provider on behalf of itself, its insurers, successors and assigns does hereby waive any and all rights of subrogation against Dublin relating to or arising from any loss or damage which is within any insurance coverage of Service Provider, regardless of whether a claim has been submitted to or denied by the insurer.

INDEMNIFICATION AND DUTY TO DEFEND

Except to the extent expressly prohibited by statute, Service Provider agrees to fully indemnify and hold harmless Dublin and its elected officials, agents, officers, representatives, attorneys, employees, volunteers, indemnities, independent contractors and invitees from and against any and all claims, causes of action, amounts, damages, demands, expenses, judgments, liabilities, losses, obligations, proceedings and costs, including actual attorneys' fees, expert witness fees and costs incurred, that in whole or in part, arise out of, involve, result from, relate to or are alleged to have been caused by:

(a) The performance of any aspect of the Work by Service Provider or any of its subcontractors, independent contractors, suppliers, manufacturers, materialmen or persons or entities for whose acts Service Provider is or may be liable and/or their respective agents and/or employees;

(b) Act(s), failure(s) to act, omission(s) or negligence of or by Service Provider or any of its subcontractors, suppliers, manufacturers, materialmen or persons or entities for whose acts Service Provider is or may be liable and/or any of their respective agents and/or employees.

(c) Injury or death to persons or damage to property which arises out of, involves, results from, relates to or is caused by, in whole or in part, any action(s), inaction(s) and/or negligence of or by Service Provider or any of its subcontractors, independent contractors, suppliers, manufacturers, materialmen or persons or entities for whose acts Service Provider is or may be liable and/or any of their respective agents and/or employees.

(d) The failure of Service Provider to pay its subcontractors, suppliers, materialmen, laborers, union fringe benefits or any other obligation arising in the performance of the Work.

This indemnification provision shall not be construed to negate, abridge or reduce any other rights of Dublin and its elected officials, agents, officers, representatives, attorneys, employees, volunteers, indemnities, independent contractors and invitees.

In the event that any such claims, loss, cost, expense, liability, damage or other injury arise or are made or threatened against any indemnity hereunder, Dublin shall have the right to withhold any payments due or to become due to Service Provider an amount sufficient in its judgment and sole discretion to protect and indemnify in accordance with this provision against any and all such claims, loss, damage, cost and expense.

All indemnity obligations set forth in this Agreement shall survive the termination of this Agreement or the completion of Service Provider's Work.

CHANGES, CLAIMS AND DELAYS
CHANGES

Change to Agreement

Without invalidating this Agreement, Dublin may change, add to or reduce the Work to be performed hereunder. Any such change may be authorized as set forth herein.

Change Order

A Change Order is a document prepared by Dublin and signed by Service Provider stating their agreement upon the change in the scope of the Work, adjustment in the Contract Price and/or to the Project Schedule.

Adjustment in Contract Price

Service Provider shall not be entitled to receive compensation for extra work, materials or changes of any kind regardless of whether ordered by Dublin or Dublin's Representative, unless a written Change Order has been previously issued and signed by Dublin. If a change was ordered by Dublin or Dublin's Representative, and Service Provider performed but did not receive a written Change Order, Service Provider shall be deemed to have waived any claim for extra compensation, including anything related to schedule impacts or lost productivity, regardless of any written or verbal protests or claims by Service Provider. Dublin's issuance of a signed, written Change Order shall be deemed and construed as a condition precedent to Service Provider's filing of a valid claim for extra compensation as a result of Service Provider's performance of any work not originally included as part of the original scope of Work. If a Change Order requires an adjustment in the Contract Price, the adjustment shall be established by one of the following methods:

(a) mutual agreement on a lump sum, which shall be supported by sufficient information submitted by Service Provider to substantiate the amount, including specifically a labor, material, equipment and Service Provider's cost breakdown;

(b) unit prices already established in the Agreement or if not established by the Agreement then established by mutual agreement for the adjustment;

(c) on a time and material basis or, if none, then as otherwise allowed by the Contract Documents, or, if none, as jointly acceptable.

(d) for overtime work, Service Provider shall only be entitled to recover the premium time differential without mark-up of any kind.

Agreement on any Change Order shall constitute a final settlement, and full accord and satisfaction, of all matters relating to the change in the Work that is the

subject of the Change Order, including, but not limited to, the cumulative effect on the Project of all change orders issued to the date thereof, all direct and indirect costs, home office overhead and any and all adjustments to the Contract Price or Project Schedule.

CLAIMS

Claim

A claim is a demand or assertion made in writing by Dublin or Service Provider seeking an adjustment to the Contract Price and/or Project Schedule, an adjustment or interpretation of the Agreement's terms, or other relief arising under or relating to this Agreement, including the resolution of any matters in dispute between Dublin and Service Provider in connection with the Project.

Timing of Claims

Claims by Service Provider must be made within 21 days after occurrence of the event giving rise to such Claim. Claims must be initiated by written notice to Dublin and must be submitted through the "Statement of Claim" Form attached As Exhibit A to this Agreement. Any submitted "Statement of Claim" Forms must be complete, accurate and contain all information requested by the "Statement of Claim" Form. Failure by Service Provider to present written claims within 21 days of the event giving rise to the claim through the "Statement of Claim" shall constitute an express waiver of any rights to additional time, money or other relief.

Claim Documentation

All Claims presented or submitted by Service Provider shall include all supporting documentation and information to allow Dublin to evaluate the Claim. Dublin may request any additional documentation or information from Service Provider (whether maintained in any form or medium) to assist in assessing and evaluating Service Provider's Claim, and Service Provider agrees to provide the same.

Within ten (10) days of its receipt of a written request, Service Provider shall make available to Dublin or Dublin's Representative any books, records or other documents or information in its possession, custody or control relating to any Claim. Service Provider shall also require its subcontractors and suppliers, regardless of tier, to do likewise.

DELAYS/TIME IMPACT

Should Service Provider delay the progress of the Work so as to cause Dublin to suffer or become liable for any damages, Service Provider agrees to pay to Dublin the full amount

of any and all such damages. Such damages, at Dublin's option, may be deducted from any payments due, or which become due, under the Agreement. Nothing in this paragraph shall limit Dublin's right to claim all actual damages sustained by it as a result of Service Provider's delay. In addition, Dublin may terminate this Agreement for default as provided in Article 13 herein.

Dublin shall have the right, at any time, to delay or suspend the start or prosecution of the whole or any part of the Work under this Agreement, or to vary the sequence of performance thereof. Progress schedules may from time to time be modified to conform to contract completion requirements.

Dublin shall not be liable to Service Provider for delay to Service Provider's Work by reason of fire or other casualty; or on account of riots or of strikes, or other combined action of the workmen or other persons; or on account of any acts of God; or any other cause, whether foreseen or unforeseen, beyond Dublin's control.

All schedules incorporated into the Contract Documents or provided during the course of the performance of the Work are provided for the Service Provider's convenience. Dublin does not warrant or guarantee such Schedule(s) and Service Provider should not rely upon the sequence or duration of activities as set forth therein for any purpose, including the pricing of the Work. Service Provider specifically acknowledges that the sequence and duration of activities set forth in the Schedule(s) typically change on projects of this size, nature and complexity, and that they are likely to change on this Project. Dublin shall have the right to determine and, if necessary, change the time, order and priority in which the various portions of the Work is to be performed and all other matters relative to the timely and orderly conduct of the Work.

PAYMENT
GENERAL PROVISIONS

Schedule of Values

If the Agreement is not a unit price agreement, then the Service Provider shall prepare and submit to the Contractor prior to the due date for the submission of Service Provider's first application for payment, a Schedule of Values apportioned to the various divisions or phases of the Work. The Schedule of Values shall include line items for each portion of the Work. Each line item contained in the Schedule of Values shall be assigned an appropriate monetary price such that the total of all such items shall equal the Contract Price. The Schedule of Values shall be prepared in such detail as may be required by Dublin.

Payment Use and Verification

Service Provider is required to pay for all labor, materials, and equipment used in the performance of the Work. Reasonable evidence, satisfactory to Dublin, may be required to show that all obligations relating to Subcontract Work are current before releasing any payment due to Service Provider. If required by Dublin, before final payment is made for the Work, Service Provider shall submit evidence satisfactory to Dublin that all payrolls, bills for materials and equipment, and all known indebtedness connected with the Agreement and the Work, have been paid or otherwise satisfied.

Taxes

Service Provider agrees to withhold all municipal income taxes due or payable under the provisions of Chapter 181 of the Codified Ordinances of Dublin, Ohio, for wages, salaries and commissions paid to its employees and further agrees to require that all of its subcontractors shall also withhold any such municipal income taxes due under such chapter for any work completed or services performed related to this Project.

Payment Not Acceptance

Payment to Service Provider by Dublin does not constitute or imply acceptance of any portion of the Work.

PROGRESS PAYMENTS

Applications

Service Provider's Applications for Payment shall, unless otherwise required by Dublin or the Contract Documents, be submitted on the AlA 0702 form and shall be itemized and supported by the Service Provider's Schedule of Values, unit prices, and any other substantiating data as required by Dublin.

Partial Lien Waivers and Affidavits

Service Provider shall obtain from all of its subcontractors, vendors and suppliers, regardless of tier, a waiver of claim under the relevant mechanic’s lien laws for the Project of all claim or lien rights for the amounts for which they have received payments with respect to the Project in the form attached hereto as Exhibit B to the Agreement.

Rejection of Service Provider's Payment Application

Dublin may reject a Service Provider’s payment application or nullify a previously approved payment application, in whole or in part, as may reasonably be necessary to protect Dublin from loss or damage based upon:

(a) Service Provider's repeated failure to perform the Work as required by the Contract Documents;

(b) loss or damage arising out of or relating to the Contract Documents and caused by Service Provider to Dublin;

(c) Service Provider's failure to properly pay for labor, materials, equipment or supplies furnished in connection with the Work;

(d) rejected, nonconforming or defective Work, which has not been corrected in a timely fashion;

(e) reasonable evidence of delay in performance of the Work such that the Work will not be completed in accordance with the Project Schedule, and that the unpaid balance of the Contract Price is not sufficient to offset the additional costs or damages that may be incurred by Dublin as a result of the anticipated delay caused by Service Provider;

(f) reasonable evidence demonstrating that the unpaid balance of the Contract Price is insufficient to cover the cost to complete the Work; or

(g) third party claims involving Service Provider or reasonable evidence demonstrating that third party claims are likely to be filed unless and until Service Provider furnishes Dublin with adequate security in the form of a surety bond, letter of credit or other collateral or commitment which are sufficient to discharge such claims if established.

Payment Amount

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

1. The portion of the Contract Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Price allocated to that portion of the Work in the schedule of values, less retainage of ten percent (10%). Pending final determination of cost to Dublin of changes in the Work, amounts not in dispute shall be included and paid upon approval and payment by Dublin.

2. The progress payment amount shall be further modified under the following circumstance: (a) Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Price, less such amounts as Dublin shall determine for incomplete Work, retainage applicable to such Work and unsettled claims.

3. Dublin shall not make advance payments to Service Provider for materials or equipment, which have not been delivered and stored at the site unless the Contract Documents allow otherwise.

Time of Application

For each progress payment period, Service Provider shall submit its progress payment application to Dublin for the Work performed to date no later than the fifth day of each month, unless otherwise agreed.

Stored Materials and Equipment

To the extent permitted by the Contract Documents, applications for payment may include materials and equipment not incorporated into the Work. Approval of payment applications for materials and equipment stored on or off the site shall be conditioned on submission by Service Provider of bills of sale and applicable insurance or such other procedures satisfactory to Dublin to establish the proper valuation of the stored materials and equipment.

Time of Payment

Dublin shall make progress payments for all undisputed amounts to Service Provider for satisfactory performance of the Work no later than twenty (20) calendar days after receipt of Service Provider's complete payment application.

FINAL PAYMENT

Application

Service Provider may submit its final payment application to Dublin upon acceptance of the Work by Dublin, and upon Service Provider furnishing evidence of fulfillment of the Service Provider's obligations in accordance with the Agreement.

Requirements

When submitting its final payment application, Service Provider shall furnish the following to Dublin:

(a) the Final Waiver of Lien form attached hereto as Exhibit C. Such form shall be in the amount of the application for final payment and be accompanied by the same Final Lien Waiver form executed by Service Provider's subcontractors, materialmen and suppliers;

(b) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Dublin might in any way be liable, have been paid or otherwise satisfied;

(c) consent of Service Provider's surety to final payment, if applicable and required;

(d) satisfaction of closeout procedures required by Dublin;

(e) current certificates of insurance establishing that all insurance coverage required by the Agreement shall remain in effect through the final acceptance of the Project by Dublin, or such later date as may be required by the Contract Documents, and that such coverage will not be materially altered, expire or terminate without thirty (30) days prior certified mail notice thereof; and

(f) other data if required by Dublin, such as receipts, releases, and waivers of liens effective upon payment. Acceptance of final payment by Service Provider shall constitute a waiver of any and all claims (whether known or unknown) by Service Provider except those previously made in writing and identified by Service Provider as unsettled at the time of final application for payment.

Time of Payment

Final payment of the undisputed balance due of the Contract Price shall be made to Service Provider within ten (10) calendar days after receipt of all information required under Section 12.3 of this Agreement.

DISPUTE RESOLUTION

INITIAL DISPUTE RESOLUTION

If a dispute arises out of, or relates to this Subcontract or the alleged breach thereof, the parties shall endeavor to settle the dispute first through direct discussions by and between the parties respective Project Managers or principals.

If the dispute cannot be settled through direct discussions, the parties shall then endeavor to settle the dispute by mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association. Notice of demand for mediation shall be filed in writing with the other party to this Agreement with the American Arbitration Association. The demand for mediation shall be made within a reasonable time after written notice of the claim, dispute or other matter in question has been given, but in no event shall it be made when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statues of limitation. The location of the proceedings shall be in Dublin, Ohio, unless the parties agree otherwise. The parties shall share all costs of the mediation equally.

ARBITRATION/LITIGATION

In the event that a dispute is not resolved as set forth above, Dublin shall have the right, in its sole and exclusive discretion, to elect whether the dispute will then be decided by arbitration or litigation. In the event that Dublin should elect to resolve the dispute through Arbitration it shall so notify Service Provider in writing. The parties will then meet or confer to reach agreement on an arbitrator. The arbitration shall be conducted in general conformity with the Construction Industry Rules of the American Arbitration Association, however, the American Arbitration Association shall not administer the arbitration. The locale of any arbitration hearing shall be Dublin, Ohio. Any award rendered in the arbitration shall be final and binding upon the parties and may be enforced in any court of competent jurisdiction.

In the event that Contractor should elect to resolve the dispute through litigation jurisdiction thereof shall reside exclusively with the Common Pleas court of Franklin County, Ohio.

PREVAILING PARTY

In the event of any arbitration, the prevailing party shall be awarded its share of the arbitration costs and arbitrator compensation. For the purpose of the application of this provision, the arbitrator(s) shall determine the prevailing party as follows: the prevailing party shall be that party who's last written settlement position (demand/offer) made before the commencement of the arbitration hearing(s) is closest to the final award rendered by the arbitrator(s). In order to be considered for the purpose of this provision, any settlement position (demand/offer) must be in writing and must have been delivered by certified mail to the other party. It is the intent of this provision for the arbitrator(s) to identify the true party prevailing in any arbitration proceeding. To that end, in the event that a party seeking relief has not taken a settlement position, i.e. the claimant, the arbitrator(s) shall consider the settlement demand to be the full relief requested in the arbitration demand. In the event that the respondent has not taken a settlement position, the arbitrator(s) shall consider the offer to be a complete rejection of the relief requested by the claimant. Where there are mixed claims and counterclaims, the determination of the prevailing party shall be within the discretion of the arbitrator(s) consistent with the intent of this provision."

WORK CONTINUATION AND PAYMENT

Service Provider shall carry on the Work and maintain the Project Schedule pending final resolution of a Claim including mediation, arbitration or litigation, unless the Agreement has been terminated or the Work suspended as provided for in the Agreement, or the parties otherwise agree in writing to a partial or total

suspension of the Work. If Service Provider is continuing to perform in accordance with the Agreement, Dublin shall continue to make undisputed payments as required by the Agreement.

RECOURSE BY DUBLIN

FAILURE OF PERFORMANCE

Notice to Cure

If Service Provider refuses or fails to supply enough properly skilled workers, proper materials, or maintain the Project Schedule, or it fails to make prompt payment to its workers, subcontractors or suppliers, disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a breach of a provision of this Agreement, Service Provider may be deemed in default of this Agreement. If Service Provider fails within three (3) working days after written notification to commence and continue satisfactory correction of such default, with diligence and promptness, then Dublin without prejudice to any other rights or remedies, shall have the right to any or all of the following remedies:

(a) supply such number of workers and quantity of materials, equipment and other facilities as Dublin deems necessary for the satisfactory correction of such default, which Service Provider has failed to complete or perform after the aforesaid notice, and charge the cost thereof to Service Provider, who shall be liable for the payment of same including reasonable overhead and profit;

(b) contract with one or more additional contractors, to perform such part of the Work, as Dublin shall determine will provide the most expeditious correction of the default and charge the cost thereof to Service Provider;

(c) without further notice to Service Provider, withhold payment of monies due the Service Provider in accordance with this Agreement; and

(d) in the event of an emergency affecting the safety of persons or property (as determined in Dublin's sole discretion), Dublin may correct such default, without first giving three (3) working days' written notice to Service Provider, but shall give prompt written notice of such action to Service Provider, and charge the cost thereof to the Service Provider.

Service Provider agrees to indemnify and hold Dublin harmless from and against any and all damage, loss, cost or expense, including the actual attorneys' fees incurred, arising from or relating to the default of Service Provider, regardless of whether Service Provider cures the default or is ultimately determined not to have been in default of its obligations under this Agreement, in which event the termination shall be deemed to have been a termination for Dublin's convenience.

Termination by Dublin

Termination for Default/Cause

If Service Provider fails to commence and satisfactorily continue correction of a default within three (3) working days after written notification from Dublin, then the Agreement may be terminated and Dublin may use any materials, implements, equipment, appliances or tools furnished by or belonging to Service Provider to complete the Work. Dublin shall issue a written notice of termination to Service Provider at the time the Agreement is terminated.

Dublin may also furnish those materials, equipment, and/or employ such workers or subcontractors, as Dublin deems necessary to maintain the orderly progress of the Work. Service Provider hereby consents to the assignment of its subcontracts or agreements which Dublin, in its sole discretion, deems necessary for the orderly progress of the Work, immediately upon the issuance of a determination of default.

All costs incurred by Dublin in performing the Work, shall be deducted from any monies due or to become due Service Provider under this Agreement. Service Provider shall be liable for the payment of any amount by which such expense may exceed the unpaid balance of the Contract Price.

Termination for Convenience

Dublin shall have the right to terminate this Agreement for its convenience by providing Service Provider with written notice thereof. Upon Service Provider's receipt of such notification it shall immediately cease work on the Project and take all steps reasonably available to minimize the cost of termination. In the event of such termination, Service Provider shall be entitled to receive as full and complete compensation the value of Work that is properly completed up to the date of termination as identified on the schedule of

values, the cost of any stored material not previously paid for or incorporated in the Work which can not be returned or restocked, and reasonable direct costs of demobilization.

Service Provider shall not be entitled to compensation for any field or home office overhead or any profit on work not performed.

In the event that any court or arbitration panel should determine that a termination of Service Provider by Contractor for cause was a breach of the Agreement, any such termination shall immediately be converted to a termination for convenience and Service Provider's damages shall be so calculated.

Use of Service Provider's Equipment

If Dublin performs work under this Article, or subcontracts such work to be so performed, Dublin and/or the persons to whom work has been subcontracted shall have the right to take and use any materials, implements, equipment, appliances or tools furnished by, belonging or delivered to Service Provider and located at the Project for the purpose of completing any remaining Work. Immediately upon completion of the Work, any remaining materials, implements, equipment, appliances or tools not consumed or incorporated in performance of the Work, and furnished by, belonging to, or delivered to the Project by or on behalf of Service Provider, shall be returned to Service Provider in substantially the same condition as when they were taken, normal wear and tear excepted.

BANKRUPTCY

Termination Absent Cure

Should there be filed by or against Service Provider a petition in bankruptcy, or for a reorganization, or should Service Provider become insolvent or be adjudicated as bankrupt or go into receivership, liquidation or dissolution, either voluntarily, involuntarily or under court order, or make a general assignment for the benefit of creditors, or otherwise acknowledge insolvency, then in any such event, each of which shall constitute a default hereunder on the Service Provider's part, Dublin shall have the right, in addition to any other rights and remedies provided by this Agreement, the Contract Documents or by law, to proceed in accordance with the provisions of Article 14 of this Agreement.

Interim Remedies

If Service Provider is not performing in accordance with the Project Schedule at the time a petition of bankruptcy is filed, or at any subsequent time, Dublin may avail itself of such remedies under this Article as are reasonably necessary to maintain the Project Schedule.

EQUAL OPPORTUNITY EMPLOYMENT

Service Provider shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin. Service Provider shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, age or national origin.

Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Service Provider agrees to post in conspicuous places, available to

employees and applicants for employment, notices, which may be provided by Dublin setting forth the provisions of this equal opportunity pledge and commitment.

Service Provider shall comply with all provisions of the DPW Regulation on EEO, and the implementing rules, regulations and applicable orders of the State Equal Employment Opportunity Coordinator.

DUBLIN/OWNER:

CITY OF DUBLIN, OHIO

By: _____

Its: _____

Date: _____

SERVICE PROVIDER:

_____

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM:

_____ Date: _____

Law Director

CERTIFICATION OF FUNDS

DUBLIN COMMUNITY RECREATION CENTER GEOTHERMAL PROJECT

at 5600 Post Road

I, Angel L. Mumma, Deputy City Manager - Director of Finance of the City of Dublin, Ohio, certify that:

1. The Council of the City of Dublin, Ohio has appropriated $_____ for the above-referenced project by Resolution No. _____ adopted on _____, 20__.

2. The amount so appropriated is on deposit or in the process of collection to the credit of the appropriate fund free from any outstanding obligations.

CITY OF DUBLIN, OHIO

Date: _____

By:_____
Angel L. Mumma
Deputy City Manager – Director of Finance

NOTICE TO PROCEED
Not Applicable ___

To: _____

_____

_____

You are hereby notified to commence work within ten (10) business days from the date of receipt of this Notice to Proceed. You are required to complete the work within **ninety (90) consecutive calendar days.**

Return an acknowledged copy of this Notice to Proceed to:

Brian Ashford
Administrative Services - Facilities
6555 Shier Rings Road
Dublin, Ohio 43016

CITY OF DUBLIN, OHIO

Date: _____

By: _____
Brian Ashford
Facilities Manager

RECEIPT OF NOTICE TO PROCEED

Receipt of this Notice to Proceed is hereby acknowledged this ____ day of _____, 201__.

Company Name: _____

Signature: _____

Print Name: _____

Title: _____

NOTICE OF COMMENCEMENT OF PUBLIC IMPROVEMENT

Not Applicable ___

Section 1311.252, Ohio Revised Code

Notice is hereby given of the commencement of a public improvement as follows:

1. The public improvement is identified as:

Project Name:
Dublin Community Recreation Center Geothermal Project

Project Number:

Location: **5600 Post Road**

2. The public authority responsible for the public improvement is:

City of Dublin, Ohio
5200 Emerald Parkway
Dublin, Ohio 43017

3. The principal contractor and its surety on the public improvement are as follows:

Principal Contractor:_____	Surety:_____
Name_____	Name _____
Address _____	Address_____
City, State_____	City, State_____
Zip Code_____	Zip Code_____
Telephone Number _____	Telephone Number_____

4. The City of Dublin, Ohio first executed a contract with a principal contractor for the public improvement on _____ .

5. The name and address of the representative of the City of Dublin, Ohio upon whom service may be made for the purposes of serving an affidavit pursuant to Section 1311.26 of the Ohio Revised Code is:

Brian Ashford, Facilities Manager
Facilities Department
6555 Shier Rings Road
Dublin, Ohio 43016

CITY OF DUBLIN, OHIO

By:_____
Brian Ashford
Facilities Manager

Sworn to and subscribed before me this _____ day of _____, **20__**.

_____
Notary Public

CHANGE ORDER

Change Order No. _____ Contractor Name: _____

Date: _____

Agreement Date: _____

The following changes are made to the contract documents:

_____
_____
_____
_____
_____

The changes are made for the following reasons:

_____
_____
_____
_____
_____

Change to contract price:

Original contract amount:	$ _____
Current contract amount adjusted by previous Change Orders:	$ _____
The contract will be (circle one: increased/decreased) due to this Change Order by:	$ _____
New contract amount (including this Change Order):	$ _____

Change to contract time:

The contract time will be (circle one: increased/decreased) due to this Change Order by _____ calendar days.

The date for completion of all work will be _____, **2015**.

This Change Order is signed this _____ day of _____, **2015**.

CONTRACTOR

_____

_____

Print Name: _____

Title: _____

CITY OF DUBLIN, OHIO

By:_____
Marsha I. Grigsby
City Manager

By:_____
(signature)

By: _____
Brian Ashford
Facilities Manager

By: _____
Angel L. Mumma
Deputy City Manager - Director of Finance

SECTION 4
GEOTHERMAL SPECIFICATIONS

Contract Documents

Contractor shall review the complete contract specifications and drawings, which are incorporated into this contract. All addenda shall be listed on the bid form. Contractor shall contact the A/E prior to bidding regarding any questions/clarifications needed prior to bidding in order to provide a complete, operational system described in the contract documents.

SECTION 00 01 15

LIST OF DRAWINGS

GENERAL

G0 TITLE SHEET AND DRAWING INDEX

CIVIL DRAWINGS

C1.0 SITE PLAN AND PROFILES
C2.0 EXISTING DETAILED PLANS
C3.0 MISCELLANEOUS NOTES

ARCHITECTURAL DRAWINGS – Not Used

STRUCTURAL DRAWINGS – Not Used

FIRE PROTECTION – Not Used

PLUMBING – Not Used

HVAC

HD11	PARTIAL FIRST FLOOR HVAC COURTYARD DEMOLITION PLAN
HD12	PARTIAL FIRST FLOOR HVAC DEMOLITION PLAN
H01	HVAC SITE PLAN
H11	PARTIAL FIRST FLOOR HVAC COURTYARD PLAN
H12	PARTIAL FIRST FLOOR HVAC PLAN
H21	HVAC SCHEMATICS AND DETAILS
H22	HVAC SCHEDULES AND GENERAL NOTES

ELECTRICAL

E01	ELECTRICAL SITE PLAN
ED11	PARTIAL FIRST FLOOR ELECTRICAL COURTYARD DEMOLITION PLAN
ED12	PARTIAL FIRST FLOOR ELECTRICAL DEMOLITION PLAN
E11	PARTIAL FIRST FLOOR ELECTRICAL COURTYARD PLAN
E12	PARTIAL FIRST FLOOR ELECTRICAL PLAN
E22	ELECTRICAL RISER, SCHEDULES AND GENERAL NOTES

END OF SECTION 00 01 15

SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Work covered by Contract Documents.
2. Work under a single prime contract.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Dublin's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents as a single contract and consists of the following:

1. General Trades Work: Removal of walls, concrete pads, floors, and other general trades items, architectural and structural work associated with new heat exchanger enclosure, wall openings, and other work associated with new HVAC equipment as described in the Contract Documents. General Trades work will be the responsibility of the HVAC contractor.

2. Hazardous Materials Abatement Work: No hazardous materials are anticipated at this site; notify the A/E and the City of any suspected hazardous materials.

3. Fire Suppression Work: Relocate sprinklers as needed for new construction; no sprinklers are required at the new heat exchanger enclosure.

4. Plumbing Work: Modify domestic water piping, storm water piping, sanitary piping, vent piping, and other plumbing piping as required for mechanical improvements. Provide new storm drain to the parking area storm system for well water discharge.

5. HVAC Work: Provide demolition of existing cooling towers and associated pumps/piping. Provide two new well water-to-condenser water heat exchangers, two well pumps, two condenser water pumps, associated piping and controls for the new geothermal heat

rejection system shown on the contract documents. Provide temporary connections to temporary cooling tower as needed to maintain building chilled water supply during construction. HVAC work includes all site work (wells, directional-boring of piping, etc.), unless noted otherwise.

6. Electrical Work: Provide new branch power circuiting, wire, conduit, and other items described in the Contract Documents in support of the Mechanical Improvements. Existing electrical switchgear will remain. Relocate light fixtures in the existing mechanical room as required for new piping. Provide power and lighting for new heat exchanger enclosure at the mechanical courtyard.

B. Type of Contract: Single Prime Contract; refer to the General Conditions.

C. Commissioning:

1. The Contractor shall participate in the HVAC Commissioning process, as prescribed in the Contract Documents.

2. The Contractor shall permit the A/E or the Commissioning Agent (CxA) access to commission performance based equipment, and/or systems prior to final acceptance or partial occupancy if applicable.

3. The A/E shall promptly notify, in writing, the Contractor responsible for the fixture, equipment and/or system, of any deficiency.

4. During testing, if issues are identified that result in needed corrections by the Contractor and the testing needs to be re-scheduled, The Contractor shall pay all reasonable costs of CxA, separate Contractors, the Owner, and the Contracting Authority for delay, interference, hindrance or disruption of the Project due to Contractor without fault of the Separate Contractors, the Owner, the A/E, or the Contracting Authority, the Contractor shall pay the CxA for retest costs.

5. Provide installation and start-up forms required for commissioning for all equipment, coordinate with the A/E and Commissioning agent as needed for functional testing. Functional testing will start after all work (including balance of systems) is complete and tested to the satisfaction of the A/E, with all start-up and testing forms submitted and approved.

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in multiple phases of the occupied building, and shall be coordinated with other work by other trades being completed in the building.

B. Phased construction shall be proposed by the Contractor. Work shall be phased to minimize interruptions to the building's chilled water system. The building will remain occupied through out the construction phase. The project shall have full cooling available from June 1 to October 1, and shall have a minimum of one chiller operational for all other times of the year.

C. Interruption of the chilled water system shall be scheduled a minimum of two weeks in advance; work shall continue 24 hours per day, 7 days per week, until chilled water is restored to the building.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Dublin has awarded separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Combination Heat and Power – work is currently on-going to install a new CHP unit at the mechanical courtyard.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period, as coordinated and approved by the A/E and the City of Dublin. See the General Conditions.

B. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to the City of Dublin, Dublin's employees, public, and emergency vehicles at all times. Do not use these areas for parking or storage of materials, unless specifically approved by the A/E and the City.
1. Schedule deliveries to minimize use of driveways and entrances by construction operations.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
3. Schedule cutting and patching of driveways and installation of work in the public areas with the A/E and the City at least two weeks in advance of the start of work.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight and otherwise usable condition throughout construction period. Repair damage caused by construction operations. Relocate existing items as needed for new work, and include all relocation costs in bids. Maintain accessible space for all existing equipment.

1.7 COORDINATION WITH OCCUPANTS

A. Full Dublin Occupancy: Dublin will occupy site and the Recreation Center during entire construction period. Cooperate with Dublin during construction operations to minimize conflicts and facilitate Dublin usage. Perform the Work so as not to interfere with Dublin's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Dublin and approval of authorities having jurisdiction.
2. Notify Dublin not less than two weeks in advance of activities that will affect Dublin's operations.
3. Complete utility cross-connects and crane lifts during non-business hours on evenings or weekends, unless otherwise coordinated and approved by the A/E and Dublin.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations as described in the General Conditions and Supplementary Conditions.

B. Existing Utility Interruptions: Do not interrupt utilities serving the Recreation Center or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify A/E not less than ten days in advance of proposed utility interruptions.
2. Obtain A/E's and Dublin's written permission before proceeding with utility interruptions.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Dublin occupancy with Dublin.

1. Notify A/E and Dublin not less than two weeks in advance of proposed disruptive operations.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. RFI Documents shall be processed electronically by the A/E.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. General Conditions and Supplementary Conditions.
2. Commissioning Requirements.

1.3 DEFINITIONS

A. RFI: Request from City of Dublin, A/E, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work.

Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for City of Dublin and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values. Using Textura Construction payment management system.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals. Utilizing I Build web-based program.
5. Progress meetings.
6. Pre-installation conferences.
7. Commissioning, Balancing, and Testing
8. Project closeout activities.
9. Startup and adjustment of systems.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as University's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to A/E indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/2 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Review: The single prime Contractor will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If the Contractor determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Contractor will so inform Contractor, who shall make changes as directed and resubmit.
9. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 01 Section "Submittal Procedures."

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified in the General Conditions.

1.7 PROJECT MEETINGS

A. General: Refer to the General Conditions; project meetings and contractor coordination meetings will be held weekly.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
2. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
3. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.

B. Related Requirements:
1. General Conditions

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by A/E.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
1. PDF electronic file.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit on a daily basis through I Build format, Managed by contractor.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Special Reports: Submit at time of unusual event.

K. Qualification Data: For Contactor’s scheduling staff.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of A/E's request.

B. Pre-scheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Review delivery dates for City of Dublin-furnished products.
4. Review schedule for work of City of Dublin's separate contracts.
5. Review submittal requirements and procedures.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for Project closeout and City of Dublin startup procedures**,** including commissioning activities.
9. Review and finalize list of construction activities to be included in schedule.
10. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors. The Construction Manager is responsible for the complete project schedule.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Use of premises restrictions.
    d. Provisions for future construction.
    e. City of Dublin Holidays
    f. City of Dublin Exam weeks.
    g. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Completion of mechanical installation.
    b. Completion of electrical installation.
    c. Substantial Completion.

D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling by Contractor: The single prime Contractor will provide planning, evaluation, and reporting using CPM scheduling.

1. Meetings: Contractor’s scheduling staff shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to A/E**,** City of Dublin, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their

assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. The purpose of the Construction Progress Schedule is to allow the Contractor and the A/E to prepare an orderly plan to aid in the timely completion of the Project.

1. For clarity, this Section uses the term Contractor for activities performed by the Prime Contractor's Scheduler, or the Contractor depending on the party with contractual responsibility for their timely completion in accordance with the applicable General Conditions.

B. The approved Construction Progress Schedule will be used to plan and execute the work, to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis for all progress payments.

C. Contractors shall cooperate and coordinate with each other, and with the A/E and the City of Dublin, to provide all scheduling requirements in their respective schedules in accordance with the Contract Documents.

D. Failure to maintain the Construction Progress Schedule in an approved status may result in the City of Dublin withholding a monetary penalty against the responsible Contractor until the schedule is approved.

E. Related Sections:

1. Document 00 72 16 - General Conditions

1.02 PROJECT SCHEDULING SEQUENCE REQUIREMENTS

A. The Contractor will prepare a Construction Progress Schedule for all work included under the scope of each Contract, in accordance with the General Conditions.

1. The Contractor will schedule and conduct a Schedule Kick-Off Meeting. All Sub-Contractors are required to attend.

a. The Contractor will prepare and furnish to all contractors a Master Activity Coding template, in hard copy electronic format and defining the Responsibility Code, Work Area Code, Milestones, Phase Code, etc. for the Construction Progress Schedule, as outlined in this section. Contractors shall submit subsequent schedule requirements in accordance with the Master Activity Code template to achieve continuity in merging scheduling input.

b. The Contractor will prepare and distribute a schedule framework of proposed construction sequence to the Contractors.

2. The Contractor will prepare and furnish a detailed schedule framework, in hard copy electronic format, to the Sub-Contractors.

a. Contractors shall utilize the detailed schedule framework to prepare their Construction Progress Schedule for their specific scope of work.

b. The Contractor will schedule and conduct a minimum of two Schedule Sequence Review Meetings with mandatory attendance by all Contractors to meet the Construction Progress Schedule submission requirement within 60 calendar days after the Notice to Proceed is issued.

B. Sub-Contractors shall provide Construction Progress Schedule requirements specified herein to the Contractor so that they can prepare a fully coordinated Construction Progress Schedule.

C. The Contractor will submit the Construction Progress Schedule, with signatures of all Sub-Contractors, indicating approval by all contractors to the A/E.

1. If acceptable, the A/E and Dublin will accept the schedule.

2. If not acceptable, the schedule will be returned to the Contractor for revision. The revised schedule, with approval signatures for all Contractors, shall be resubmitted.

PART 2 PRODUCTS

2.01 SCHEDULE SOFTWARE

A. The computer software utilized by the Contractor to produce the project schedule will be Primavera Products as marketed by Primavera Systems, Inc. or a substitution accepted by the A/E.

PART 3 EXECUTION

3.01 CRITICAL PATH METHOD

A. The Critical Path Method (CPM) of network calculations will be used to generate the schedule. The Contractor shall provide the schedule in either the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM).

3.02 LEVEL OF DETAIL REQUIRED

A. With the exception of the preliminary schedule submission, the Construction Progress Schedule shall include an appropriate level of detail. Failure of the Contractor to develop or update the schedule or provide resource information will result in the disapproval of the schedule.

B. Activity Durations:

1. Submit the following data to support the schedule calendar as it relates to durations. Failure of the A/E to include this data will delay the review of the submittal until the Contractor receives the missing data.

2. Tasks

3. Task Priority

4. Labor Hours/Man-Days

a. The proposed number of working days per week.

b. The holidays to be observed during the life of the contract (by day, month and year).

c. The planned number of shifts per day.

d. The number of hours per shift.

e. Break up the work into activities of a duration no longer than 20 work days each, except as to non-construction activities (e.g., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities for which the Dublin may approve a longer duration.

C. Procurement Activities:

1. Prepare the schedule in chronological order of submittals. Show specification section of the submittal, name of contractor and generic description of work covered. Include activities to cover the complete procurement process to include but not limited to: submittal, review, approval, resubmittal, procurement, fabrication, delivery, permits, and similar pre-construction work.

D. Manpower:

1. Activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity.

2. Identification of manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as two shifts per day, six day work week, specified overtime, or work at times other than regular days or hours shall clearly be identified in the Project Schedule.

3. Critical or near Critical Paths resulting from the use of manpower or equipment restraints shall be kept to a minimum. Near Critical Paths are defined as paths having 10 workdays or less of total float.

E. Cost:

1. All activities shall be cost loaded in a logical manner tying to each Contractor’s Schedule of Values.

2. A/E and City of Dublin shall review the contractor’s schedule of values prior to the start of work.

F. Responsibility:

1. All activities shall be identified in the Construction Progress Schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the Contracting Firm, the Subcontracting Firm, Contractor Workforce, or Agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

G. Work Areas:

1. Arrange the schedule to show each major area of construction for each major category or unit of work.

2. All activities shall be identified in the Construction Progress Schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

H. Modification or Claim Number:

1. Any activity that is added or changed by a change order or used to justify any claimed time, shall be identified by change order code that changed the activity. Activities may not belong to more than one change order.

I. Milestones:

1. Milestone dates are defined in calendar days following the date set forth in the Notice to Proceed and are required to be met by all Contractors. Time is of the essence for the completion of Milestones and for the Contract Completion date.

2. The following Milestone dates are defined in calendar day from the Notice to Proceed, and shall be adhered to by each Contractor.

a. Milestone M1 – Phasing Plan complete – 10 days after notice.

b. Milestone M2 – Demolition of Cooling Tower #2 complete – 40 days after notice.

c. Milestone M3 – New Heat Exchanger Activation – 130 days after notice.

d. Milestone M4 – Complete project – 150 days after notice.

3.03 SCHEDULED PROJECT COMPLETION

A. Project Start Date:

1. The Construction Progress Schedule may start no earlier than the date that the Notice to Proceed (NTP) was issued. The Contractor shall include as the first activity in the Construction Progress Schedule an activity called “Notice to Proceed.” The “Notice to Proceed” activity shall have: an “ES (early start) constraint, a constraint date equal to the date that the NTP was issued, and a zero day duration.

B. Constraint of Last Activity:

1. Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the Critical Path. The A/E shall include as the last activity in the Project Schedule an activity called “Contract Complete”. The “Contract Complete” activity shall have a: “LF” (late finish) constraint, a constraint date equal to the completion date equal to the date identified in the NTP for the project, and a zero day duration.

3.04 INTERIM COMPLETION DATES (MILESTONES)

A. Contractually specified interim completion dates (Milestone dates) shall also be constrained to show negative float if early finish date of the last activity in that phase falls after the interim completion date.

3.05 HAMMOCK ACTIVITIES FOR CONTRACTS

A. The Contractor shall include a hammock type activity for each Contractor. The Contractor activity shall be logically tied to the earliest and latest activities in the Contractor's Scope of Work. Hammock activities shall be identified within "HA" at the beginning of the Activity ID.

3.06 DEFAULT PROGRESS DATA DISALLOWED

A. Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM Scheduling Software Systems. Actual Start and Finish dates and Remaining Durations on the CPM Schedule shall match those dates provided from Contractor Daily Reports for every in progress or completed activity and insure that the data contained on the Daily Reports is the sole basis for schedule updating. Failure to comply may result in the disapproval of schedule.

3.07 OUT OF SEQUENCE PROGRESS

A. Activities that have posted progress without predecessors being completed (Out of Sequence Progress) shall be allowed only by the case by case approval of the A/E and the City of Dublin. The A/E may direct that changes in schedule logic be made to correct any or all Out of Sequence Work.

3.08 NEGATIVE LAG(S)

A. Lag durations contained in the schedule shall not have a negative value.

3.09 DEFINITION OF, AND CONDITIONS RELATING TO FLOAT

A. Float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity in the schedule. Total float is defined as the amount of time any given activity or path of activities may be delayed before it will affect the project completion time.

B. Float is not time for the exclusive use or benefit of the Contractor, and shall be used in the best interest of completing the project on time.

C. Extensions of time for performance required under the General Conditions pertaining to equitable time adjustment will be granted only to the extent that the equitable time adjustment exceeds total float in the activity or path of activities affected at the time approval was issued for the change.

D. Use of float suppression techniques such as preferential sequences, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for rejection of the Construction Progress Schedule and any revisions or updates.

3.10 PRELIMINARY CONSTRUCTION PROGRESS SCHEDULE

A. The preliminary Construction Progress Schedule, defining the Contractor's planned operations for the first 90 calendar days shall be submitted for approval within 10 calendar days after Notice to Proceed is issued. The approved preliminary schedule shall be used for payment purposes and the basis for measuring Contractor progress not to exceed 60 days after Notice to Proceed is issued.

1. Paper copies shall be provided in color on minimum 11 inch by 17 inch paper.

B. Schedule Review and Comments

1. Comments made by the A/E on the Construction Progress Schedule during review shall not relieve the Contractors from compliance with the requirements of the Contract Documents.

2. Following the Contractor's receipt of the A/E's review comments, the Contractors shall correct the schedule to identify missing activities and relationships relevant to the Scope of Work. No time extensions will be granted to complete activities not initially included in the Contractor's Construction Progress Schedule.

3. To the extent that there are any conflicts between the approved Construction Progress Schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

C. Resubmittal of Construction Progress Schedule

1. Should the A/E reject the Construction Progress Schedule, the Contractor shall comply with the A/E's direction and resubmit the Construction Progress Schedule and all associated submittals within 7 calendar days.

3.11 APPROVED CONSTRUCTION PROGRESS SCHEDULE

A. The Construction Progress Schedule approved by the Contractors shall be submitted for acceptance within 60 calendar days after the Notice to Proceed is issued. It shall provide a reasonable sequence of activities which represent work through the entire project and a reasonable level of detail.

1. Paper copies shall be provided in color on minimum 11 inch by 17 inch paper.

B. The approved Construction Progress Schedule shall show the sequence and interdependence of activities required for complete performance of the work, beginning with Contractor's receipt of the Notice to Proceed and concluding with the date of Final Completion of the Contract. The Construction Progress Schedule shall show all activities in workdays, with allowance for holidays and the effects of normal weather conditions on outside work.

C. The approved Construction Progress Schedule shall comply with all limits imposed by the Scope of Work, with all contractually specified intermediate milestones and completion dates, and with all constraints, restraints, or sequences included in the Contract.

D. The Construction Progress Schedule network (graphic presentations) and computer tabulations, the Resource Loading curve and the Contractor's signatures shall be submitted to the A/E for acceptance. Additionally, the Contractor shall submit two copies of the data, containing the resource loaded Construction Progress Schedule.

E. The following computer generated reports in hard copy shall be required as part of the Preliminary and Approved Construction Progress Schedule submittals:

1. Activity ID Report

2. Total Float/Early Start Report

3. Logic Report

4. Resource Report

5. Coding Dictionary

F. The schedule network (graphic presentation) shall include:

1. Activity ID

2. Activity Description

3. Original Durations

4. Remaining Durations

5. Early Start and Finish Dates

6. Baseline Start and Finish Dates

7. Total Float

8. Percent Complete

G. The schedule shall be sorted by Early Start and Total Float and shall show both the Early and Target Schedule.

H. The City of Dublin shall accept or reject, in writing, the Construction Progress Schedule and the associated submittals. If the Construction Progress Schedule is rejected, the City of Dublin shall provide comments in writing to the A/E stating the reasons why the submission was not accepted.

3.12 Periodic Schedule Updates

A. The following computer generated reports in hard copy and electronic format shall be required as a part of the monthly update thereof as a condition precedent to the receipt of progress payments under the Contract.

B. The Contractor's monthly narrative report is to include:

1. Activities started in the month (with actual start dates).

2. Activities completed during the month (with actual start and completion dates).

3. Activities in progress (with estimated remaining durations).

4. Activities scheduled to start in the next month (with estimated start dates).

5. A list of approved logic changes.

6. A list of proposed logic changes, new activities, and deleted activities.

7. Recommendations for adjusting the Construction Progress Schedule to meet milestone completion and Contract completion dates (include why the schedule needs adjusting, e.g., change order, weather, contractor resources, etc.).

8. Attach copies of the Contractors' weekly schedule reports.

C. The Contractors graphic presentation of the schedule is to include:

1. Activity ID.

2. Activity Description.

3. Original Durations.

4. Remaining Durations.

5. Early Start and Finish Dates.

6. Baseline Start and Finish Dates.

7. Total Float.

8. Percent Complete.

9. The schedule shall be sorted by Early Start and Total Float and should show both the early schedule and the target schedule.

D. Electronic data supporting the update shall be provided.

E. Computer generated reports are to include:

1. Activity ID Report.

2. Total Float/Early Start Report.

3. Logic Report.

4. In Progress or Planned to Start Report.

5. In Progress or Planned to Finish Report.

6. Resource Report.

3.13 TWO-WEEK LOOK AHEAD SCHEDULE SUBMISSION

A. The Contractor shall provide a two-week Look Ahead Schedule for review at the Progress Meeting that occurs closest to the 15th of each month. The Look Ahead Schedule will be based on the most recent monthly update and will show only those activities that are scheduled to begin or are in progress during the week before and for two weeks after the 15th of the current month. The two-week Look Ahead Schedule reports will contain the following information for each activity and will be required from the Contractor throughout the duration of the project unless directed otherwise by the A/E.

1. Activity I.D.

2. Activity Description

3. Original Duration

4. Remaining Duration

5. Early Start Date

6. Early Finish Date

7. Percent Complete

8. Total Float

9. Bar Graph Presentation

3.14 STANDARD ACTIVITY CODING DICTIONARY

A. The Contractor shall submit, with the Construction Progress Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, A Responsibility Code Value, “ELE”, may be identified as “Electrical Subcontractor”. Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Preliminary (first 90 calendar day) Project Schedule Submission, changes to the activity coding scheme shall be approved by the A/E.

3.15 DATA

A. The preliminary, approved, and update Construction Progress Schedules shall be provided in the form of electronic files.

B. File Medium:

1. Submit data on media acceptable to the A/E.

C. File Name:

1. The Contractor shall insure that each file submitted has a name related to the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will insure that the names of all the files submitted are unique. The Contractor shall submit the file naming convention to the A/E.

3.16 APPROVED CHANGES VERIFICATION

A. Only Construction Progress Schedule changes that have been previously approved by the A/E shall be included in the schedule submission. The narrative report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

B. The Contractor shall prosecute the work in accordance with the approved Construction Progress Schedule. Out of sequence construction, defined as a change from the Construction Progress Schedule in the Contractor’s actual operation requires prior approval from the A/E.

C. Upon the approval of a change order or the issuance of a unilateral change order by the Contracting Authority the agreed upon change order activities, activity durations, logic and impacts shall be reflected in the next schedule submittal by the A/E.

D. No change to the approved activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the Construction Progress Schedule shall be made without prior approval from the A/E. If the Contractor desires to make a change to the approved Construction Progress Schedule, the Contractor shall request permission from the A/E in writing, stating the reasons for the change as well as the specifics, such as the proposed changes in activities,

original activity durations, logic, interdependencies, milestones, planned sequence of operations, or resource loading of the baseline Construction Progress Schedule. The A/E shall respond within 14 calendar days after the receipt of the Contractor's request.

E. If the A/E considers the Construction Progress Schedule change requested by the Contractor to be a major change, it may require the Contractor to revise and submit for approval, without additional cost to the Dublin, all of the affected portions of the network diagrams, and any schedule reports, or construction equipment reports deemed necessary to show the probable effect on the entire project. The proposed network revision and required reports shall be submitted to the A/E within seven calendar days after the A/E notifies the Contractor that the requested revision is a major change. Only upon the approval of the requested change by the A/E may it be reflected in the next Construction Progress Schedule update submitted by the Contractor.

F. A change will be considered of a major nature if the time estimated for an activity or sequence of activities is varied from the original plan to the degree that there is reasonable doubt that the Contract Completion date or milestones will be met, or if the change impacts the work of other Contractors at the job site. Changes to activities having adequate float may be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Contract Completion date or milestones.

3.17 SCHEDULE REPORTS

A. The format of each activity for the schedule reports listed below shall contain:

1. Activity ID Number(s).
2. Activity Description.
3. Original Duration.
4. Remaining Duration.
5. Early Start Date.
6. Early Finish Date.
7. Baseline Start Date.
8. Baseline Finish Date.
9. Total Float.
10. Actual Start and Actual Finish dates shall be printed for those activities in progress or completed.

B. Activity ID Report: A list of all activities sorted according to Activity ID number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

C. Logic Report: A list of preceding and succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

D. Total Float Report: A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

3.18 NETWORK DIAGRAM (GRAPHIC PRESENTATION)

A. The network diagram is required on the preliminary, baseline and monthly schedule submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The A/E will use, but is not limited to, the following conditions to review compliance with this paragraph:

1. Continuous Flow: Diagrams shall show a continuous flow from left to right. The Activity ID, description, original duration, remaining duration, early start and finish dates, target start and finish dates, total float and percent completed shall be shown on the diagram.

2. Project Milestone Dates: Dates shall be shown on the diagram from start of any project, any contract required interim completion dates, and contract completion dates.

3. Critical Path(s): The Critical Path(s) shall be clearly shown.

4. Banding: Activities shall be grouped to assist in the clear understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
2. Division 32 Section "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the A/E, building occupants, testing agencies, and authorities having jurisdiction.

B. Sewer Service: The City of Dublin will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: The City of Dublin will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: The City of Dublin will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations. Connections shall be complete with backflow prevention devices.

F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in ADAAG guidelines and City of Dublin requirements.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts.

B. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated (exterior applications only) wood posts spaced not more than 8 feet apart.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel office activities of the contractor. Contractor will provide meeting space, and any needed space for the A/E. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Locate at areas designated by the A/E and the City of Dublin.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Permanent HVAC systems shall remain in use during the construction period.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Permanent HVAC System: Permanent HVAC system for temporary use during construction shall be provided with filters with MERV of 8 at each return-air grille in system and remove at end of construction.
3. Provide temporary cooling tower connection as needed to maintain chiller(s) in operation during construction. Carefully coordinate cooling tower demolition to have the heat exchangers/well system operational prior to disconnecting the cooling towers. Contractor shall consider future weather conditions and operating hours of the Recreation Center when determining service interruptions to the chilled water system.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, A/E, City of Dublin, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to sanitary and storm as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Contractor shall provide temporary toilets, for use of construction personnel.

1. Toilets: With prior approval of the City of Dublin, use of Owner's existing toilet facilities may be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating and Cooling: Contractor shall provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Maintain HVAC systems to the Recreation Center at all times.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Connect temporary service to Owner's existing power source, as directed by Owner.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

L. Telephone Service: Each contractor shall provide temporary telephone service via wireless telephones for their staff.

3.3 SUPPORT FACILITIES INSTALLATION

A. Project Signs: A project sign is not required for this project; provide temporary signage as needed.

1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

b. Provide signage as needed to communicate power outages, utility outages, and testing of systems (fire alarm, for example) that impact on students and staff.

2. Maintain and touchup signs so they are legible at all times.

B. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

C. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

D. Existing Elevator Use: Use of Owner's existing elevators is NOT permitted.

E. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Protect all existing trees during construction; no excavation is permitted within the drip line of trees.

F. Site Enclosure Fence: Before construction operations begin, provide site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

K. Temporary Partitions: As required, provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by the City of Dublin staff and Recreation Center visitors from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Acceptable manufactures are listed in the specifications; no other comparable products may be submitted.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, A/E will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to the City of Dublin.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for the City of Dublin.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. The City of Dublin reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," A/E will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Visual Selection Specification: Where Specifications include the phrase "as selected by A/E from manufacturer's full range" or similar phrase, select a product that complies with requirements. A/E will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal. Submit copies of receipts issued by landfill facility, indicating percentages of debris diverted from landfills.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify A/E of locations and details of cutting and await directions from A/E before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Electrical wiring systems.
    j. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Equipment supports.

d. Piping, ductwork, vessels, and equipment.
e. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in A/E's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable design requirements Section.

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

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to A/E for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Coordinate existing utility locations with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to A/E according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify A/E promptly.

B. General: Lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels for exterior site work.
2. Establish limits on use of Project site.

3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify A/E when deviations from required lines and levels exceed allowable tolerances.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by A/E.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 92 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels. Do not disrupt classroom instruction.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by A/E.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties, including roof warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Administrative and Procedural Requirements for Cutting and Patching

B. Related Documents:

1. Refer to other the "General Conditions – Stipulated Sum (Multiple-Prime Contract)" and other Sections of these Specifications, for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.02 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.03 SUBMITTALS

A. Cutting and Patching Proposal:

1. Where approval of procedures is required before proceeding, submit a proposal describing procedures in advance of the time cutting and patching will be performed. Include the following information, as applicable:

a. Describe the extent of cutting and patching required and how it is to be performed. Indicate why it cannot be avoided.

b. Describe anticipated results, include changes to structural elements and operating components and changes in the building's appearance and other visual elements.

c. List products to be used and entities that will perform work.

d. Indicate dates when cutting and patching is to be performed.

e. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

1) Ten (10) day advance notification is required for ALL utility outages.

f. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

g. Architect’s Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval to proceed does not waive the Architect's right to later require complete removal and replacement of work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

A. Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.

B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Structural elements include, but are not limited to:

1 Structural concrete

2 Structural steel

3 Lintels

4 Miscellaneous structural metals

5 Equipment supports

C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to:

1 Primary operational systems and equipment.

2 Air or smoke barriers.

3 Fire-suppression systems.

4 Mechanical systems piping and ducts.

5 Control systems.

6 Communication systems.

7 Electrical wiring systems.

D. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include, but are not limited to:

1 Water, moisture, or vapor barriers.

2 Membranes and flashings.

3 Equipment supports.

4 Piping, ductwork, vessels, and equipment.

5 Noise-and vibration-control elements and systems.

E. Visual Requirements

1. Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would reduce the building's aesthetic qualities, or result in visual evidence, in the City of Dublin Representative and Architect's opinion, of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

F. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.05 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible. Use materials whose performance will equal or surpass of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before cutting, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.02 TEMPORARY SUPPORT:

A. Provide temporary support of Work to be cut.

3.03 PROTECTION:

A. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.

B. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

C. Take all precautions to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems, when possible, before cutting to minimize interruption to occupied areas.

3.04 PERFORMANCE

A. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

B. Cut existing construction to provide for the installation of other components or the performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

3.05 CUTTING:

A. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review procedures with the original installer; comply with the original installer's recommendations.

B. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

C. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

D. Proceed with patching after construction operations requiring cutting are complete.

3.06 PATCHING:

A. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

B. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

1. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

a. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

b. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

2. Patching shall include painting of surface in areas not scheduled for new paint. Paint shall be extended to nearest corner or other termination point as acceptable to the Architect.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

3.07 CLEANING:

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit and similar features before painting or finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01 73 29

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous demolition and construction waste.
   2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

   1. Division 01 Section "Multiple Contract Summary" for coordination of responsibilities for waste management.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
   a. Concrete.
   b. Concrete reinforcing steel.
   c. Brick.
   d. Concrete masonry units.
   e. Wood studs.
   f. Wood joists.
   g. Plywood and oriented strand board.
   h. Wood paneling.
   i. Wood trim.
   j. Structural and miscellaneous steel.
   k. Rough hardware.
   l. Roofing.
   m. Insulation.
   n. Doors and frames.
   o. Door hardware.
   p. Windows.
   q. Glazing.
   r. Metal studs.
   s. Gypsum board.
   t. Acoustical tile and panels.
   u. Carpet.
   v. Carpet pad.
   w. Demountable partitions.
   x. Equipment.
   y. Cabinets.
   z. Plumbing fixtures.
   aa. Piping.
   bb. Supports and hangers.
   cc. Valves.
   dd. Mechanical equipment.
   ee. Refrigerants.
   ff. Electrical conduit.
   gg. Copper wiring.
   hh. Lighting fixtures.
   ii. Lamps.
   jj. Ballasts.
   kk. Electrical devices.
   ll. Switchgear and panelboards.
   mm. Transformers.

2. Construction Waste:

   a. Masonry and CMU.
   b. Lumber.
   c. Wood sheet materials.
   d. Wood trim.
   e. Metals.
   f. Roofing.
   g. Insulation.
   h. Carpet and pad.
   i. Gypsum board.
   j. Piping.
   k. Electrical conduit.

l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: As directed by the A/E Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.

5. Remove recyclable waste from the Owner's property and transport to recycling receiver or processor.

END OF SECTION 01 74 19

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Division 01 Section "Execution" for progress cleaning of Project site.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Occupancy: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For final Contractor's inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Occupancy: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by A/E. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain A/E and Owner's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment. Complete Commissioning.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by A/E, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of A/E's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by A/E. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of A/E.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
    a. PDF electronic file. A/E will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of A/E for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 10 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment[**,** and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Division 01 Section "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. A/E will comment on whether content of operations and maintenance submittals are acceptable.

2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to A/E.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. A/E, through the Contractor, will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 90 days before commencing demonstration and training. A/E will comment on whether general scope and content of manual are acceptable, and will return comments 15 days from receipt of the initial manual.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. A/E and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with A/E's comments. Submit copies of each corrected manual within 15 days of receipt of A/E's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the

Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for A/E.
7. Names and contact information for major consultants to the A/E that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Water leak.
4. Power failure.
5. Water outage.
6. System, subsystem, or equipment failure.
7. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Division 01 Section "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
2. Division 01 Section "Execution" for final property survey.
3. Division 01 Section "Closeout Procedures" for general closeout procedures.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set of marked-up record prints.
2) A/E will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set of marked-up record prints.
2) Submit PDF electronic files of scanned record prints.

3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order.
k. Changes made following A/E's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with A/E. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to A/E through Construction Manager for resolution.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where A/E determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of A/E.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project. A/E will review as-built drawings monthly.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for A/E's and Construction Manager's reference during normal working hours.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Requirements:

1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

C. Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor and videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

   a. Name of Project.
   b. Name and address of videographer.
   c. Name of A/E.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by A/E.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:

   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.

e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. A/E will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Contractor and the A/E, with at least twenty one days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration-based performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to .mp4 format file type, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

FIRE PROTECTION SPECIFICATIONS
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CITY OF DUBLINSECTION 21 05 00
FIRE PROTECTION - GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. Sections 21 00 00 through 21 99 99 (as included), cover Fire Protection work specifically.

B. Applicable Division 1 and General Conditions terms and conditions (if any).

C. Applicable building construction authorities, codes, standards and guidelines for all Fire Protection Contract elements, including but not limited to the following:

1. State of Ohio Building Code, including Fire Protection portions thereof.

2. State of Ohio Fire Marshall's Office.

3. NFPA pamphlet no. 13, INSTALLATION OF SPRINKLER SYSTEMS.

4. NFPA pamphlet no. 14, INSTALLATION OF STANDPIPE AND HOSE SYSTEMS.

5. NFPA pamphlet no. 70, NATIONAL ELECTRIC CODE.

6. NFPA pamphlet no. 72, NATIONAL FIRE ALARM CODE.

7. American National Standards Institute (ANSI) standards for materials and construction.

8. American Society of Mechanical Engineers (ASME) standards for materials and construction.

9. American Society for Testing and Materials (ASTM) standards for materials, construction and testing.

10. Underwriter's Laboratories (UL) standards for materials and construction.

11. Factory Mutual (FM) standards for materials and construction.

12. The manufacturer's installation guidelines and recommendations for individual items, elements and/or systems indicated herein.

13. The City of Dublin's material and installation guidelines and/or standards.

14. The University's insurance underwriter's material and installation guidelines and/or standards.

1.02 SCOPE

A. The Fire Protection Contractor shall furnish all labor, materials, tools, incidentals and details necessary to provide a complete system of Fire Protection work as herein specified, as shown on plans, and as indicated or required by work under separate contract included with complete project documentation. Coordinate installation and interface requirements with the appropriate contractors in advance.

B. Note that work in this contract is associated with the overall remodeling/renovation of an existing structure. Extent of overall remodeling/renovation work shall be as indicated by and confirmed from architectural documentation. Unless indicated otherwise, the following conditions shall apply to work in this contract:

1. All existing fire protection items/elements within the structure are to remain, unless noted otherwise. New fire protection piping to connect to and extend from the existing standpipes in the building.

2. This contractor shall be responsible for removal, repair and replacement of existing structures (floors, walls, partitions, ceilings, etc.) as necessitated by new work, or removal of existing items/elements. Repair and replacement to match original condition and adjacent structures in type, kind and finish.

3. Connect to existing sprinkler piping provided in previously renovated spaces, and provide sprinklers on piping in the renovated areas.

C. The edition of all applicable NFPA Pamphlet's as recognized and amended by the Building Code Inspection/Approval Authority shall be the minimum requirement for all materials and methods. Unless indicated otherwise, and as a quality standard only, all materials shall be listed by Underwriter's Laboratories, Inc., and Factory Mutual Laboratories as approved for fire protection installations, when such is available.

D. Fire protection sprinkler installation to be as required to provide "fully sprinkled" protection/coverage for the entire building at the completion of the renovation.

E. In brief, the Scope of the Work shall include, but is not limited to the following:

1. Automatic “Wet” Sprinkler Systems throughout the area renovated, based upon design flow and pressure information. Relocate sprinklers as needed for new MEP system installation.
2. Layout Drawings, including all required design calculations and flow tests.

F. Wiring:

1. Unless indicated otherwise, all internal operation/control wiring incidental to the fire protection system shall be the responsibility of the Fire Protection Contractor, except wiring indicated by the Electrical Contract Documentation shall be by the Electrical Contractor. Electrical contract work includes external power input wiring to Fire Protection contract items/elements, and wiring for flow alarms, supervisory switches, and any other alarm initiating or supervisory devices to and from the central fire alarm panel provided in the Electrical Contract.

2. All wiring (if any) in the Fire Protection contract, including low voltage, shall be installed in conduit. All wiring, conduit and installation shall be in accordance with

the National Electrical and Fire Alarm Codes, and the requirements of Division 16, Electrical Specification.

3. The Fire Protection Contractor shall coordinate with the Electrical Contractor as required for proper installation and operation of items wired by the Electrical Contractor. This includes providing the locations of all devices to be wired to the Electrical Contractor at the first opportunity, and coordinating the voltage and any other electrical requirements for all devices.

G. The Fire Protection Contractor shall not submit or bid the sprinkler system as a gridded type system.

H. This Contractor to be licensed by the State of Ohio for installation and service of fire protection systems, including alarm, detection, control and extinguishing components as indicated herein.

I. Failure on the part of the Fire Protection Contractor to fulfill the above requirements will not relieve him of the responsibility of executing all work necessary for a complete and approved installation without extra expense to the City of Dublin.

J. PROTECTION AND CLEANING

1. Protect all fixtures, equipment, piping & other elements installed in this contract against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.

1.03 GENERAL CONDITIONS

A. Refer to the Instructions to Bidders and to Document 00 72 16, “General Conditions” for scheduling, material hoisting, cleaning, coordination, service interruption, and other general conditions.

B. Extreme care shall be taken to avoid interference with the City of Dublin's operations, processes, personnel & equipment, especially in the existing portion of the building occupied by the City of Dublin& in use during construction. Consult with the A/E regarding any points where interference is likely to occur and follow dimensions carefully where given on the Drawings. Pay particular attention to minimum clear heights when indicated on the Drawings.

C. DRAWINGS

1. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.

2. Piping and equipment layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and equipment to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

3. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of

any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in his Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the City of Dublin's representative.

4. The City of Dublin's representative reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the City of Dublin.

5. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between ductwork, piping, etc. and the ceiling.

6. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

7. See General Conditions, Article 4, Section 4.7, for additional coordination drawing requirements.

J. OPERATING AND MAINTENANCE INSTRUCTIONS

1. This Contractor shall thoroughly instruct and supervise the City of Dublin's Maintenance Personnel in the proper operation and maintenance of the fire protection system equipment. This Contractor shall be responsible for arranging and scheduling the instruction and supervision, and for notifying the City of Dublin's representative at least 48 hours in advance. See Division 01 for additional information.

2. Instructions shall include the following:

   a. Location of equipment and explanation of what it does.

   b. Reference to "Operating Instruction Manuals" for record and clarity.

   c. Coordination of written and verbal instruction so that each is understood by all personnel.

   d. Specific maintenance to be performed by theCity of Dublin.

3. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. Submit preliminary copy 45 days following the receipt of all approved shop drawings. After final approval, provide four (4) copies of Operation and Maintenance Instructions for submittal to City of Dublin. Final copies shall be submitted 30 days prior to training. Instructions shall consist of the following items:

   a. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Architect, name of Engineer.

   b. Second Page: Index of Manual Contents.

c. First Section: A copy of each approved & corrected submittal with an index at the beginning of the section.

d. Second Section: A list of all equipment used on the project, together with supplier's name and address.

e. Third Section: Manufacturer's maintenance manuals for each item of equipment furnished under this Contract. Manuals shall include such items as parts lists, detailed service instructions, procedures for performing normal maintenance & service functions, preliminary trouble shooting procedures and wiring diagrams. Wiring diagrams to be as actually wired including control and interlock wiring.

f. Fourth Section: Routine and 24-hour emergency information:

1. Name, address and telephone number of servicing agency.

2. Include names of personnel to be contacted for service arrangements.

K. RECORD DOCUMENTS

1. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications as required by the General Conditoins, Article 1, Section 1.4.

2. Submit As-Built documents as required by General Conditions, Article 10.

L. SUPERVISION

1. This Contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

M. UNACCEPTABLE WORK AND OBSERVATION REPORTS

1. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

2. The Contractor shall promptly correct all work found unacceptable in accordance with the General Conditions, Article 2, Section 2.19.

N. FINAL INSPECTION

1. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall proceed as required under the General Conditions, Article 10.

O. GUARANTEE

1. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year and as required by the General Conditions, Article 2, Section 2.17, “Warranty”.

P. PERMITS AND FEES

1. Refer to the General Conditions, Article 2, for Contractor responsibilities regarding permits. The A/E will obtain the general building permit. The Fire Protection Contractor shall apply for and pay any other review, inspection, permit, license, testing and/or other service fees required by all review/inspection/approval authorities in connection with the work under this Contract.

1.04 DESIGN

A. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of his work with work performed under all other Contracts.

B. Sprinkler systems shall be designed, sized hydraulically and installed according to NFPA Pamphlet No. 13, and the rules and regulations of all review, inspection and approval authorities (required for final approval). See Plans for specific design information, including zoning, flow and density, allowances and head spacing.

C. If the Contractor has any questions concerning the Plans and Specifications, he is to feel free to contact the Engineer for clarification before Bids, and to fully understand the extent and responsibilities of his work. Refer to the Instructions to Bidders, Article 2, for bidding procedures.

D. Unless indicated otherwise at specific areas and/or locations, location of all sprinkler heads shall be determined by the Fire Protection Contractor, as required for protection specified, and final approval.

E. All sprinkler heads to be aligned in respect to each other and building structural elements to present a uniform, even appearance.

F. The Fire Protection Contractor is responsible for locating all sprinkler heads in one of the optional ceiling tile installation points as detailed on drawings for gridded lay-in ceilings.

G. The Fire Protection contractor shall refer to Architectural Reflected Ceiling Plans for locations of sprinkler heads at specific areas indicated. Relocation of these heads (if required), is subject to approval by the Architect.

H. Location of sprinkler heads by the Fire Protection Contractor is subject to approval by the City of Dublin's Representative in review of the "Preliminary" Plans Submittal specified herein. The City of Dublin's Representative reserves the right to relocate heads during this review, providing sprinkler protection is not compromised, and no conflicts occur with NFPA or inspection/approval authorities requirements as a result of relocations.

1.05 FIRE PROTECTION SUPPLEMENTAL INFORMATION

A. Water Source and Supply:

1. Work under this contract will be designed based on flow and pressure information stated on the drawings and specifications, based on a recent flow test completed by TP Mechanical, Columbus, Ohio.

B. Building Information:

1. See Architectural Documentation for detailed building code, occupancy classification(s) and construction information.

2. See complete Architectural documentation, including plans, elevations, sections and details for additional information affecting fire protection work.

1.06 TESTING AND INSPECTION

A. Testing:

1. Sprinkler Installation: The testing of the sprinkler installation shall conform to the applicable provisions of NFPA Pamphlet No. 13.

2. Upon completion, and prior to the acceptance of the installation, the Contractor shall furnish the City of Dublinwith four (4) copies of the certification required. Testing of all piping for the Fire Protection system is to be made in accordance with the National Fire Protection Association and in the presence of a representative of the City of Dublinand Insurance Company. As a minimum, a copy of "Contractors Certificate of Materials and Tests" properly executed and verifying satisfactory tests shall be furnished to the City of Dublinupon completion of the tests.

B. Inspection: When all work has been completed, the Contractor shall conduct a preliminary but complete inspection and testing of the installation. The system, as a whole, and all component parts thereof, shall receive all inspections and tests necessary to assure that the materials, equipment, devices and all functional operations meet the requirements of this specification and standards referenced herein.

C. The City of Dublin's Representative (A/E) shall be notified of all scheduled tests at least 48 hours in advance so that he may witness same. If the Contractor performs any test or adjustment without theCity of Dublin's Representative present or without properly notifying theCity of Dublin's Representative, the Contractor will be required to perform the test or adjustment a second time in the presence of the City of Dublin's Representative.

1.07 COORDINATION

A. All work shall be done in a neat and workmanlike manner and this Contractor shall coordinate his work with all other Contractors on the project to ensure that his work does not interfere with the proper installation of work by other trades.

1.08 FIRE PROTECTION PLANS AND CALCULATIONS

A. Prepare plans and calculations for review and approval by the City of Dublin's Representative, the Insuring Agency and the review/inspection/approval authorities. Documentation (including plans and calculations) to be as specified in NFPA Pamphlet No. 13.

B. ***Submit four (4) sets of plans and calculations to the City of Dublin's Representative for "Preliminary" review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the City of Dublin's Representative, prior to submittal to the inspection/approval authorities***.

C. Submit three (3) sets of plans and calculations to the Insurer for “Preliminary” review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the insurer, prior to submittal to the inspection/approval authorities.

D. After plans and calculations have been reviewed and approved for construction by the review/inspection/approval authorities, provide four (4) sets of the documentation with all required stamps and approvals to the City of Dublin’s Representative for “Final” review and record.

E. If applicable, wiring diagrams for all items included in the fire protection system shall be submitted for review, along with equipment submittals, plans and calculations. This includes manufacturer’s standard diagrams for pre-wired items/elements such as tamper and flow switches, as well as any custom configured items/elements such as detection/control panels.

1.09 SUPERVISION

A. This Contractor shall have in charge of the work, on the job as required, during construction, a competent superintendent experienced in the work installed under this Contract.

1.10 BUILDING AUTHORITIES REVIEW & INSPECTION

A. The Contractor is responsible for arranging & scheduling required construction reviews & inspections with the Building Authorities, including on-going inspections at code specified stages of construction as well as final inspection.

B. The Contractor is responsible for compliance with all Building Authorities review and inspection directives in regard to methods of installation code compliance, including appropriate types & uses of materials, equipment & other elements specified.

C. The Contractor is responsible for satisfactorily addressing all specific Building Authorites concerns & comments generated by their review & inspection in regard to methods of installation code compliance, including appropriate types & uses of materials, equipment & other elements specified. This shall include response to the Building Authorities in writing if necessary, with copies to the City of Dublin’s representative.

D. When the work is completed, the Contractor shall furnish the City of Dublin’s representative a Certificate of Final Inspection and Approval from the Building Authorities for the Fire Protection Systems installation as required for project closeout.

PART 2 PRODUCTS

2.01 GENERAL

A. Where items/elements are indicated herein to be listed/approved, the intent of this specification is that said item/element shall be listed by all applicable material/construction standards and subject to final approval (including methods of installation) by all review/inspection/approval authorities.

B. Unless indicated otherwise, all Fire Protection contract items/elements (pipe, fittings, valves, specialties, fixtures, equipment, etc.) materials, construction, performance, testing

and methods of installation to be as listed/approved by all applicable material/construction/installation standards for same, and be in accordance with the requirements of all review/inspection/approval authorities. This includes, but is not limited to, the standards and authorities referenced in this specification. In the absence of such standards and/or requirements, the item/element manufacturer's recommendations, as confirmed by the Fire Protection Contractor in advance, shall be followed.

C. Unless indicated otherwise, all piping shall be in accordance with the following standards in regard to materials, construction, dimensions/tolerances, type of service/transmission medium (water, air, gas, etc,) and methods of installation (as applicable), and shall be so listed. Final approval for use is subject to the requirements of the review and inspection authorities:

1. Steel pipe, steel, malleable and cast iron fittings and joining methods; per applicable ASTM/ANSI/ASME standards. In addition, where utilized for potable water service, all elements shall be per applicable NSF and ASTM A53 (for carbon steel) standards.

2. Ductile iron pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/AWWA/NSF standards.

D. All items/elements shall have the manufacturer's mark or name and the quality of the product or identification of same cast, embossed, stamped or indelibly marked on each item/element in accordance with the standards under which they are accepted and approved per applicable code(s).

PART 3 EXECUTION

3.01 GENERAL

A. Where standards, codes or guidelines are referenced herein and throughout the Fire Protection Contract documentation, including plans and specifications, the latest version/edition shall be applied, unless the Building Code references another version/edition, which shall take precedence.

B. Refer to project documentation furnished with the complete construction package in advance of work for overall coordination and verification of requirements at work of other trades relating to, interfacing with, and/or impacting work in the Fire Protection Contract. This includes exact locations, quantities, physical sizes, rough-in details, pipe routing, connection sizes, etc., for items included both in the Fire Protection Contract and under separate contract. Coordinate installation and interface requirements with the appropriate contractor(s) in advance of work.

C. Include any minor details, items and/or elements essential to necessary approvals and successful operation in addition to the items specified herein and shown on plans.

D. See general "FIRE PROTECTION NOTES" on plans for additional conditions and requirements relative to the Fire Protection Contract.

E. Fire Protection items and elements shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls, surfaces and other structures through installation, bearing support or subsequent usage of Fire Protection items and elements. No framing or other support structure shall be cut, notched or bored in excess of limitations specified in the Building Code, or by the manufacturer of the

framing or other support structure, as confirmed in advance of work by the Fire Protection Contractor.

3.02 INSTALLATION OF PIPING

A. All piping systems shall be installed with adequate provisions made to prevent stresses on piping, valves and equipment.

B. Flange bolts shall be cut to proper length so that one thread projects beyond the nut when nut and bolt are tightened.

C. Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.

D. All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.

E. Provide valves and specialties where indicated on the Drawings.

F. Ream ends of pipe and clean before installing.

G. Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.

H. Valves to be installed with hand-wheel at or above center of pipe. Valves outdoors exposed to weather shall be installed with hand-wheel in the horizontal.

I. Make all changes of direction with fittings, rather than bending.

J. Flanged joints shall be faced true and square. Flanges shall be same face style as mating surface to which it is connected.

K. All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

L. Where piping is installed in accessible chases, keep all piping to sides of chase, except portions which must necessarily be in center of chase.

M. Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor. Whenever possible, pipe drops in walls to be a single length of pipe or tubing with no or minimal fittings.

N. Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight and provide pan drain to discharge at an approved location. See plumbing notes on plans for additional detail.

O. At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes during on-going construction, whether it be inadvertent or with malicious intent.

3.04 PROTECTION & CLEANING

A. After all equipment has been set it shall be thoroughly cleaned, removing all stickers, rust stains and other foreign matter and leave every part in acceptable condition, clean and ready for use.

B. After all piping & equipment has been approved and after all plastering has been completed, piping & equipment provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil, and primed (where necessary), ready for painting.

C. Repair all dents and scratches in factory prime or finish coats on all equipment, including plumbing fixtures, to the satisfaction of the City of Dublin's Representative. If damage is excessive, replacement may be required.

D. Flush out all piping systems to remove all dirt and grease from pipes and equipment before systems are placed in operation. Clean strainers after each flushing until the strainer remains clean.

E. Cover all equipment, open pipes, etc., to keep out dirt, water and weather during construction.

F. This Contractor shall clean up and remove all debris from the site on a daily basis and shall at all times keep the premises in a neat and orderly condition.

3.05 TRAINING

A. Provide 1 hours minimum of training of all equipment installed. Training of The City of Dublin staff shall take place prior to final payment.

END OF SECTION

SECTION 21 05 10
FIRE-STOPPING

PART 1 GENERAL

1.01 SCOPE

A. This Contractor shall be responsible for fire-stopping at all penetrations of rated structures by work in this contract. Fire-stopping shall be performed by an installer who has been trained & certified by a listed Fire-stopping products manufacturer in the published UL systems installation procedures.

B. Fire-stopping is defined as materials or combination of materials used to retain integrity of fire and/or smoke rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in rated structures including walls & floors.

C. Test Requirements:

1. ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops".

2. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

3. International Fire-stop Council Guidelines for Evaluating Fire-stop Systems Engineering Judgments.

4. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

   a. UL Fire Resistance Directory:

      i. Through-Penetration Fire-stop Devices (XHCR)
      ii. Fire Resistance Ratings (BXUV)
      iii. Through-Penetration Fire-stop Systems (XHEZ)
      iv. Fill, Voids, or Cavity Material (XHHW)
      v. Forming Materials (XHKU)

5. QUALITY ASSURANCE

   a. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire-stop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

   b. Fire-Stop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

   c. Proposed fire-stop materials and methods shall conform to applicable governing codes having local jurisdiction.

d. Fire-stop systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

e. For those fire-stop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Fire-stop Council.

6. SUBMITTALS

a. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL fire-stop systems to be used and manufacturer's installation instructions.

b. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install fire-stop system as described in drawing.

c. Submit material safety data sheets provided with product delivered to job-site.

7. INSTALLER QUALIFICATIONS

a. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire-stopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its fire-stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

8. DELIVERY, STORAGE, AND HANDLING

a. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

b. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

c. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

d. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

e. Do not use damaged or expired materials.

9. PROJECT CONDITIONS

a. Do not use materials that contain flammable solvents.

b. Scheduling

i. Schedule installation of CAST IN PLACE fire-stop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

ii. Schedule installation of other fire-stopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

c. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

d. Weather conditions: Do not proceed with installation of fire-stop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

e. During installation, provide masking and drop cloths to prevent fire-stopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire-stopping under conditions of service and application, as demonstrated by the fire-stopping manufacturer based on testing and field experience.

B. Provide components for each fire-stopping system that is needed to install fill material. Use only components specified by the fire-stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration fire-stop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203
4. Specified Technologies Inc., Somerville, New Jersey, (800) 992-1180
5. Nelson Fire-stop Products, Tulsa, Oklahoma, (918) 641-7299
6. Fox Couplings, Inc., Jacksonville, Florida, (904) 396-2865
7. Proset Systems Inc., Lawrenceville, Georgia, (800) 262-5355
8. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

2.03 MATERIALS

A. Use only fire-stop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire-stop Sealant
2. 3M Fire Barrier CP25 or Fire-stop Sealant 2000
3. Tremco Fyre Shield
4. STI LC Latex Endothermic Sealant and SSS Intumescent Sealant
5. Nelson LBS Sealant
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

C. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowel-able Fire-stop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet
4. STI SSM Fire Rated Mortar and SSB Fire-stop Pillows
5. Nelson CMP Fire-stop Compound and PLW Fire-stop Pillows
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

D. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Fire-stop Pillows
3. 3M CS Intumescent Sheet
4. STI SSB Fire-stop Pillows
5. Nelson PLW Fire-stop Pillows
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

E. Provide a fire-stop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which fire-stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by fire-stopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of fire-stopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Fire-stop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place fire-stop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install fire-stop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

C. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

D. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of fire-stopping caused by cutting or penetrating of existing fire-stop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire-stop materials and soiling as work progresses.

END OF SECTION

SECTION 21 05 11
VALVES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary valves for piping systems and equipment in the building required to provide proper shut off and control of systems included under this Contract.

B. Where valves are installed in potable domestic water piping they shall be listed for such service and in compliance with plumbing code materials and construction requirements.

PART 2 PRODUCTS

2.01 Gate, globe and check valves shall be Watts, Mueller, Grinnell, Crane, Hammond, Jenkins, Milwaukee, Nibco, Powell or Stockham and shall all be by the same manufacturer.

2.02 Ball valves shall be as manufactured by Apollo or any of the manufacturers listed herein for gate, globe and check valves.

2.03 Butterfly valves shall be as manufactured by Keystone, Center Line or any of the manufacturer's listed herein for gate, globe and check valves.

2.04 Each type of valve (gate, ball, globe, check, etc.) to be by a single listed manufacturer.

2.05 Gate Valves

A. 3" and larger - iron body, bronze mounted, O.S.&Y., flanged, taper solid wedge disc, rising stem, 125 lb. S.W.P. Provide chain operator for valves in restricted access locations to permit ready operation.

B. 2-1/2" and smaller - all bronze industrial grade type with threaded connections, tapered solid wedge disc, union bonnet & rising stem.

C. At the Contractor's option, gate or ball valves 2" and smaller may be "Butterball" butterfly valves Style BB1-100, bronze body with threaded ends, lever handle, stainless steel disc and stem, rated for 175 lb. W.O.G.

D. Where gate valves 2-1/2" size and smaller are indicated on plans, the Contractor has the option to provide ball valves as specified herein. Where ball valves are indicated, they are to be provided as specified herein; no options allowed.

E. Where gate valves 3" and larger are indicated on plans, the Contractor has the option to provide butterfly valves as specified herein. Where butterfly valves are indicated, they are to be provided as specified herein; no options allowed.

2.06 BALL VALVES

A. 2-1/2" size and smaller shall be three-piece bronze body ball valve with threaded connections, teflon seats, conventional port, blowout proof stem, adjustable packing gland, chrome plated bronze ball and lever handle labeled for service controlled. Rated

for 150 psig SWP & 400 WOG. Valves shall be suitable for complete service without disassembling the piping system.

B. 2-1/2" size and smaller shall be two-piece bronze body ball valve with threaded connections, union connection body, teflon seats, conventional port, blowout proof stem, adjustable packing gland, chrome plated bronze ball, and lever handle labeled for service controlled. Rated for 150 psig SWP & 400 WOG.

2.07 Unless indicated otherwise, drain valves shall be bronze construction ball valves as specified herein.

2.08 BUTTERFLY VALVES

A. 2-1/2" to 20" size shall be cast or ductile iron valve. Furnish with lug pattern body, aluminum bronze disc, stainless steel stem, EPDM seat, extended neck for full 2" insulation, and positive shut off at 175 psig W.O.G. (2-12") and 150 psig W.O.G. (14"-20").

B. When victaulic piping is specified and utilized, Victaulic Firelock Style 705 butterfly valves for piping 2" to 12" may be furnished at the Contractor's option.

2.09 Check Valves

A. 3" and larger - iron body, bronze mounted, horizontal swing check with bronze disc, flanged, 125 lb. S.W.P.

B. 2-1/2" and smaller - all bronze, horizontal swing check with bronze or TFE disc, screwed, 125 lb. S.W.P.

C. Clow, McAlear, Mueller or Metraflex non-slam check valves are acceptable manufacturers as well as previously listed manufacturers.

D. When Victaulic piping is specified and utilized, Victaulic Firelock Style 717 or similar Check valves for piping 2" to 12" may be furnished at the Contractor's option.

2.10 All valves in fire protection supply applications to be listed for such service by the manufacturer.

PART 3 EXECUTION

3.01 This Contractor shall install all valves in strict accordance to the manufacturer's recommendations.

3.02 Where drain lines are not piped to floor drains, furnish hose end adapters. Provide cap & chain for all hose end adapters.

END OF SECTION

SECTION 21 05 18
INSERTS, PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary inserts, beam clamps and auxiliary steel for pipe hangers in the building.

B. Furnish and install necessary pipe hangers and supports to properly support all piping and to maintain uniform elevation.

C. Ceiling grid systems shall not be supported from piping or equipment and vice versa. Each utility system and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure. Where interference's occur, provide trapeze type hangers or other suitable supports where they will not interfere with access to valves, equipment & other appurtenances requiring access & service.

PART 2 PRODUCTS

2.01 HANGERS

A. Hangers for steel fire lines shall be of code complaint design as dictated by NFPA, and in compliance with any other applicable Ohio codes.

2.02 Wall brackets to be similar to Grinnell figure no. 195.

2.03 Riser clamps to be similar to Grinnell figure no. 261.

2.04 Hanger support rods to be listed all-thread type sized in accordance with the hanger manufacturer's recommendations for associated piping.

2.05 Clamps & inserts to be listed assemblies provided by the hanger manufacturer for the corresponding support rod size.

2.06 Hangers, supports & accessories as manufactured/provided by Grinnell, B-Line, Michigan, PHD Manufacturing, Erico, Anvil or Modern Pipe Hangers may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Pipe clamps shall be provided at each stack & riser structural floor penetration.

3.02 Wall bracket pipe supports shall be installed where required.

3.03 Steel pipe to be supported at intervals of not over 10 feet and at base of each riser. Support elsewhere as required in accordance with good workmanship. No pipe shall be supported from another pipe.

3.04 All hangers shall be double-nutted.

END OF SECTION

SECTION 21 05 20
CUTTING AND PATCHING

PART 1 GENERAL

1.01 SCOPE

A. Cutting for all openings in structures, framing or other elements required for installation of work in this contract shall be done by this contractor with appropriate tools and methods as to prevent unnecessary damage to surrounding areas or equipment.

B. Unless indicated otherwise patching for all openings left in structures after existing plumbing elements have been removed shall be done by this contractor to match adjacent structure in type, kind & finish.

C. See General Conditions, Article 2, Section 2.1 (with Supplementary Conditions) for additional cutting and patching requirements.

PART 2 PRODUCTS

2.01 Patching & repair of structural elements to be done with listed compatible materials & methods in accordance with general contract conditions for specific types of structure when applicable.

PART 3 EXECUTION

3.01 Avoid cutting of concrete, masonry and other new work by the use of inserts and sleeves.

3.02 All holes in existing walls and floors shall be cut by use of core drills, using water to keep down the dust, and a method for catching water shall be provided. In addition, a vacuum cleaner shall be used with inlet as close to the hole being drilled as possible to pick up all dust caused by drilling.

3.03 The corners of all openings in poured concrete shall be core drilled to minimize over-cutting.

3.04 Fill and patch openings left by removal of piping and equipment in this contract to match adjacent surfaces.

3.05 Openings in rated structures shall be filled or patched in such a manner as to maintain the appropriate rating including fire-stopping if necessary.

3.06 The Protection of Persons and Property Section of the General Conditions must be followed without exception, including precautions against Fire Hazards.

3.07 No structural member will be cut without the expressed permission of the City of Dublin's Representative obtained in advance.

END OF SECTION

SECTION 21 05 30
TESTS AND ADJUSTMENTS

PART 1 GENERAL

1.01 SCOPE

A. After work has been completed the Contractor shall test and adjust the systems he has installed.

B. The City of Dublin's Representative (A/E) shall be notified of all scheduled tests and adjustments at least 48 hours before they are scheduled so that he may witness same. If the Contractor performs any test or adjustment without the University's Representative present or without properly notifying the City of Dublin's Representative, the Contractor will be required to perform the test or adjustment a second time in the presence of the City of Dublin's Representative.

C. If the City of Dublin's Representative determines that any work requires special inspection, testing, or approval, he will, upon written authorization from the City of Dublin, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the City of Dublin's Representative may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the City of Dublin's Representatives additional services made necessary by such failure; otherwise the City of Dublin shall bear such costs, and an appropriate Change Order shall be issued.

D. Concealed lines shall be tested before being concealed. If this is not done and a leak occurs during the final test, this Contractor shall repair leak and all damage resulting there-from.

E. This Contractor shall adjust all his equipment to obtain proper operation and shall demonstrate to the City of Dublin's Representative that the entire system will function properly.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 TESTS

A. All testing shall be in accordance with the applicable NFPA pamphlets listed in 21 05 00 – FIRE PROTECTION – GENERAL.

3.02 This Contractor shall check for proper alignment before starting any pumping unit with pump and driver mounted on a common base plate with flexible pipe couplings.

3.03 Before turning job over to The City of Dublin this Contractor inspect all valves and repack valves as necessary.

3.04 This Contractor shall adjust all equipment in the fire protection system to obtain proper operation and shall demonstrate to the City of Dublin's Representative that the entire system will function properly.

END OF SECTION

SECTION 21 05 50
DEMOLITION

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall be responsible for all fire protection demolition in all areas that will be renovated as part of this project. Refer to the demolition Drawings and demolition notes. The fire protection contractor shall be responsible for sprinkler piping and sprinkler relocations needed for the new work.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 Unless indicated otherwise this contractor shall be responsible for removing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the plumbing installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.

3.02 All waste materials associated by the demolition process shall be removed & clean-up performed by this contractor in accordance with general conditions of construction.

3.03 All work in this contract to be done in such a manner as to maintain or minimize interruption of plumbing utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.

3.04 Any fire protection systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the University's Representative.

END OF SECTION

SECTION 21 05 51
REMODELING

PART 1 GENERAL

1.01 SCOPE

A. This Contract shall include revisions to all fire protection work in the remodeled portions of the building necessitated to properly integrate with & function within the finished remodeled structure. The remodeled areas shall be as indicated by the Architectural and Fire protection Drawings. See Division 01 for additional requirements .

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 REMODELING

A. In all of the remodeling work the fire protection work shall follow the intent of the Fire protection Specification insofar as possible with regard to material and workmanship.

3.02 Unless indicated otherwise this contractor shall be responsible for repairing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the fire protection installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.

3.03 All waste materials associated with the remodeling process shall be removed & clean-up shall be performed by this contractor in accordance with general conditions of construction.

3.04 All work in this contract to be done in such a manner as to maintain or minimize interruption of fire protection utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.

3.05 Any fire protection systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the City of Dublin's representative.

END OF SECTION

SECTION 21 05 60
MANUFACTURER'S DRAWINGS

PART 1 GENERAL

1.01 REFERENCE

A. Sections 21 00 00 through 21 99 99 (as included).
B. Applicable Division 1 and General Conditions, including Article 13, "Action Submittals".

1.02 GENERAL CONDITIONS

A. Unless directed otherwise by the Construction Administration portion of the specifications this Contractor shall provide (6) copies of manufacturers submittal data for specific plumbing equipment, fixtures & materials to the City of Dublin's Representative for review within six weeks after the date of contract. This data shall include performance information, wiring diagrams, utility requirements & any other pertinent information necessary for appropriate evaluation. The City of Dublin's Representative will review the Contractor's submittal data for compliance with project specifications & the ability of the associated elements to be furnished & installed as a properly functioning integral element of the overall plumbing installation. Before providing a submittal to the City of Dublin's Representative the Contractor shall:

1. Review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of the Contractor.

2. Approve each submission & so stamp in advance of forwarding to the City of Dublin's Representative.

B. The required Fire Protection submittals are as follows:

1. Pipe & Fittings.
2. Sprinkler heads & accessories.
3. Hydraulic Calculations

C. The A/E shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by Contractor as indicated above. The A/E shall return without comment material not called for or which has not been approved by Contractor.

D. This Contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are <u>NOT ACCEPTABLE</u>.

E. A/E review of manufacturer's drawings or schedules <u>shall not relieve</u> the Contractor from compliance with the requirements of the plans and specifications.

F. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 Refer to the Construction Administration portion of the specifications & the A/E for specific direction in regard to processing submittals for the project, including procedures, time-tables, quantities, routing & approved format.

END OF SECTION

SECTION 21 13 13
FIRE PROTECTION PIPING SYSTEM - WET

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install a complete and approved wet sprinkler system. System to be complete with all pipe supports and offsets necessary to clear structure, and all other items/elements provided under separate contract. Connect to existing system piping in designated classrooms. Modify the existing fire protection piping in the existing building as needed for new piping and associated work.

B. Sprinkler system shall be installed complete with all necessary accessories, appurtenances and items/elements required for proper, approved operation.

PART 2 PRODUCTS

2.01 PIPING AND FITTINGS: Match existing Schedule 40 steel pipe and fittings.

2.02 ALARM INITIATING DEVICES: None anticipated for this project.

2.04 SPRINKLERS; as specified on plans.

A. In all areas having drop ceilings with surface mounted light fixtures or other items/elements that obstruct sprinkler spray, the Fire Protection Contractor shall install sprinklers with two-piece extended/dropped escutcheon assemblies in lieu of escutcheons specified with the heads.

B. Spare sprinkler head cabinet – provide cabinet at main riser location with sprinkler heads and head wrench(es) for emergency use. Spare head quantities to be as specified by NFPA pamphlet no. 13, corresponding proportionally to the total number of each type installed in the building.

C. All sprinkler heads in light and ordinary hazard occupancy applications to be listed/approved "quick response" type.

D. Sprinkler heads as manufactured/provided by Reliable, Automatic, Central, Grinnell, Gem, Star, Viking or Victaulic may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide drain valves and auxiliary drains per NFPA Requirements, and at low points of system to allow complete drainage. Contractor to be responsible to install sprinkler system to drain properly. Piping shall be installed to drain at the main riser whenever possible.

B. Install valves and specialties where indicated and/or as required for approval.

C. The entire sprinkler system installation shall conform to the requirements of NFPA pamphlet no. 13.

D. Piping must be lined up paralleling and at right angles to the building walls and other primary structural elements; angular offsets such as 45° cuts across corners and elsewhere will not be permitted unless specifically shown.

E. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which MUST be included in his Proposal Price.

3.02 Provide sleeves for pipes where piping penetrates masonry walls. All pipe penetrations through masonry walls shall be adequately sealed with mortar or approved fire resistant caulking.

3.03 SPRINKLER HEADS

A. Quantity and location of sprinkler heads to be determined by the Fire Protection Contractor, as required for proper coverage and protection in accordance with specifications on plans.

B. Unless indicated or required otherwise, nominal and quick response sprinkler head operating temperature ratings to be as follows:

1. Finished, general access areas - 165 degrees F.

2. Non-finished, restricted access areas (mechanical/electrical utility rooms, storage rooms, computer rooms with Halon suppression, etc.) – 200 degrees F.

3. The Fire Protection Contractor is responsible to determine if sprinklers with temperature ratings other than those indicated herein are required due to specific conditions at each installation, and provide sprinklers with appropriate temperature rating at these locations.

C. Recess sprinkler heads to be installed with deflectors no greater than 1/2" from maximum recessed capability. Deflectors of adjacent heads to be at same elevation, plus or minus 1/4".

D. Sprinkler heads to be aligned in respect to structure, and adjacent heads to present a uniform, even linear appearance.

END OF SECTION

PLUMBING SPECIFICATIONS

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END OF SECTION

SECTION 22 05 00
PLUMBING GENERAL

PART 1 GENERAL

1.01 REFERENCE

A. Sections 22 00 00 through 22 16 19 (as included) cover Plumbing work specifically.

B. Applicable Division 1 and General Condition's terms and conditions (if any).

C. Applicable building construction authorities, codes, standards and guidelines for all Plumbing Contract elements, including but not limited to the following:

1. State of Ohio Building Code, including Plumbing, and energy conservation portions thereof.

2. State of Ohio Board of Health.

3. NFPA pamphlet no. 70, NATIONAL ELECTRIC CODE

4. American National Standards Institute (ANSI) standards for materials and construction.

5. American Society of Mechanical Engineers (ASME) standards for materials and construction.

6. American Society of Sanitary Engineering (ASSE) standards for performance and testing.

7. American Society for Testing and Materials (ASTM) standards for materials, construction and testing.

8. American Water Works Association (AWWA) standards for materials, construction and disinfection procedures.

9. National Sanitation Foundation (NSF) standards for materials and construction.

10. Cast Iron Soil Pipe Institute (CISPI) standards for materials and construction.

11. Underwriter's Laboratories (UL) standards for materials and construction.

12. The manufacturer's installation guidelines and recommendations for individual items, elements and/or systems indicated herein.

13. The City of Dublin's material and installation guidelines and/or standards.

1.02 GENERAL CONDITIONS

A. Scheduling of all work performed by this Contractor shall be coordinated with & approved by the City of Dublin's representative. This contractor shall provide a written schedule of work to the City of Dublin's representative within (10) days after award of contract.

B. All material hoisting by trade involved.

C. Arrangements for storage of tools and material, removal of debris, and interruptions of services shall be made with the City of Dublin's representative.

D. All piping, equipment and other elements installed by this Contractor shall be located to miss all ceiling inserts, openings and sleeves for work of all trades, except where otherwise noted. This Contractor is referred to the complete construction documentation for the project available on request from the City of Dublin's representative.

E. All connections to, or revisions in, existing piping or facilities shall be done at such time as agreed to by the City of Dublin's representative, and all work shall be scheduled as required under "General Conditions". Revisions to the existing piping systems must be done with the minimum of shutdown time. All piping shall be run to the point of new connections and new equipment installed and ready to operate before any connections are to be made.

F. Extreme care shall be taken to avoid interference with the City of Dublin's equipment, especially in the existing portion of the building. Consult with the City of Dublin's representative regarding any points where interference is likely to occur and follow dimensions carefully where given on the Drawings. Pay particular attention to minimum clear heights when indicated on the Drawings.

G. It is mandatory that dust and debris be held to a minimum. This Contractor shall provide drop cloths, screens, curtains, etc., to protect the City of Dublin's equipment and personnel from dust and dirt during the course of his work. All damage to existing construction or finishes shall be repaired by this Contractor upon removal of dirt and dust protection devices. All dirt, dust and other protection devices shall be approved by the City of Dublin's representative before any work is started in the area involved.

H. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition.

I. At the completion of the project, this Contractor shall promptly clean up and remove from the site all debris and excess materials associated with the execution of work in his contract.

J. DRAWINGS

1. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping, fixture & all other elements in this contract and make minor adjustments in location necessary for coordination.

2. Piping and equipment layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and equipment to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

3. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in his Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the City of Dublin's representative.

4. The City of Dublin's representative reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the City of Dublin.

5. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in his Bid Price.

6. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to the City of Dublin.

7. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between equipment, fixtures, piping, etc. and all adjacent surfaces & structures.

8. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

9. All field adjustment & coordination modifications to work indicated by the original issue Plumbing Construction Drawings shall be properly recorded by hand & maintained on the Field Construction Drawing Set kept on site.

10. All addendums, bulletins & any other revisions issued by the City of Dublin's representative shall be posted to or maintained with the Field Construction Drawings & Specifications on site in a timely fashion.

K. When the work is completed, the Contractor shall furnish the City of Dublin's representative a Certificate of Inspection and Approval from the Board of Health for the appropriate Plumbing Contract elements before final payment will be allowed.

L. ENERGY CODE

1. All applicable elements in the Plumbing System must comply with all requirements of the State of Ohio "Code of Energy Conservation". This includes, but is not limited to, efficiencies, power factors, insulation thickness, conservation, etc.

M. UTILITIES

1. The Contractor shall investigate and locate all utilities prior to construction.

2. Each Contractor is responsible for rerouting or replacing existing utilities where necessary to permit installation of his work.

3. Support, protection and restoration of all existing on-site utilities and appurtenances required to execute work in this contract shall be the responsibility of the Contractor. The cost of this work shall be included in the price bid for work in this contract.

4. The Contractor shall immediately alert the occupants of nearby premises as to any emergency or impairment to service that he may create or discover in regard to underground utilities.

N. OPERATING AND MAINTENANCE INSTRUCTIONS

1. Plumbing work is anticipated to include only offsets to existing piping, with no new fixtures, drains, or valves anticipated. If new work is provided, this Contractor shall thoroughly instruct and supervise the City of Dublin's Maintenance Personnel in the proper operation and maintenance of the plumbing system equipment. Refer to General Conditions for additional information.

O. RECORD DOCUMENTS

1. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications. He shall neatly and correctly enter in colored pencil any deviations on Drawings affected and shall keep the Drawings available for inspection. Extra sets of Drawings will be furnished for this purpose. Refer to General Conditions for additional information.

2. At the completion of project and <u>before</u> final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to the City of Dublin’s representative.

P. SUPERVISION

1. This Contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

Q. UNACCEPTABLE WORK AND OBSERVATION REPORTS

1. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

2. The Contractor shall promptly correct all work found unacceptable by the City of Dublin’s representative whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work.

3. During the course of construction, the City of Dublin’s representative will prepare and issue "Observation Reports" including a list of items found to be in need of correction. All action items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. <u>All prior "Observation Report" items must be completed, the lists signed and</u>

returned to the City of Dublin's representative prior to making the final inspection. After the final list is issued, the same procedure will apply.

R. FINAL INSPECTION

1. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "final" inspection by the City of Dublin's representative in accordance with general conditions requirements. If more than one re-inspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the City of Dublin's representative's additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals have been submitted and approved, and all outstanding "Observation Report" action items completed, confirmed, signed and returned to the City of Dublin's representative.

S. GUARANTEE

1. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by the City of Dublin's representative.

T. PERMITS AND FEES

1. Refer to the General Conditions, Article 2, for Contractor responsibilities regarding permits. The A/E will obtain the general building permit. The Plumbing Contractor shall apply for and pay any other review, inspection, permit, license, testing and/or other service fees required by all review/inspection/approval authorities in connection with the work under this Contract.

U. PLUMBING UTILITY CONNECTIONS FOR ITEMS OR ELEMENTS NOT INCLUDED IN THE PLUMBING CONTRACT

1. Provide Plumbing supply, waste, drain, vent, and any other piped utilities included for the project as required, as listed herein, and/or as shown on the Plumbing Drawings for items furnished and/or installed under separate contract requiring same. These items shall include, but not be limited to the following:

2. HVAC equipment; final connection (where applicable) by the HVAC Contractor.

3. Rough-in Plumbing supply, waste, drain, vent, and any other piped utilities included for the project as required, as listed herein, and/or as shown on the Plumbing Drawings for all future items requiring same.

1.03 SCOPE

A. Provide pipe offsets as need for new Fire Suppression, HVAC, and Electrical work. No new plumbing fixtures or drains are anticipated as part of this project. This Contractor shall furnish all labor, materials, tools, incidentals, details, etc., necessary to provide a complete, operational and approved Plumbing System, including but not limited to all items and elements described in the Plumbing Specification and shown on the Plumbing Drawings, and as required for coordination and/or interface with work under separate contract as indicated by complete construction documentation package.

B. The Plumbing Contractor is responsible for satisfactorily addressing all review and inspection authorities' requirements and directives in regard to methods of installation necessary for final approval.

C. Note that work in this contract is associated with the partial remodeling/renovation of an existing structure. Work in this contract shall include items/elements within the remodeled/renovated area(s), as well as adjacent areas (including above and below) as necessitated for connection to and/or incorporation with existing systems. Extent of remodeling/renovation work area(s) shall be as indicated by and confirmed from architectural documentation. Unless indicated otherwise, the following conditions shall apply:

1. Unless indicated otherwise all new Plumbing Contract supply, return, waste, vent, drain, and any other piped utilities as included shall connect to, and/or operate in conjunction with existing building utility systems and elements.

2. When new work connects to, and/or operates in conjunction with existing building utility systems and elements, this contractor shall be responsible to provide an installation which shall operate and function properly without conflict or impairment to existing systems or elements upon completion of project. This shall include all necessary adjustments, balancing and confirmation of proper operation as required.

3. This contractor shall be responsible for removal, repair and replacement of existing structures that are to remain (floors, walls, partitions, ceilings, etc.) as necessitated by new work, or removal of existing work in his contract. This applies at areas within & adjacent to (including above & below) the project work area. Structural repair and replacement shall match original conditions and adjacent surfaces in type, kind and finish.

PART 2 PRODUCTS

2.01 GENERAL

A. Where items/elements are indicated herein to be listed/approved, the intent of this specification is that said item/element shall be listed by all applicable material/construction standards and subject to final approval (including methods of installation) by all review/inspection/approval authorities.

B. Unless indicated otherwise, all plumbing contract items/elements (pipe, fittings, valves, specialties, fixtures, equipment, etc.) materials, construction, performance, testing and methods of installation to be as listed/approved by all applicable material/construction/installation standards for same, and be in accordance with the requirements of all review/inspection/approval authorities. This includes, but is not limited to, the standards and authorities referenced in this specification. In the absence of such standards and/or requirements, the item/element manufacturer's recommendations, as confirmed by the Plumbing Contractor in advance, shall be followed.

C. Unless indicated otherwise, all Plumbing piping shall be in accordance with the following standards in regard to materials, construction, dimensions/tolerances, type of service/transmission medium (water, air, gas, etc,) and methods of installation (as applicable), and shall be so listed. Final approval for use is subject to the requirements of the review and inspection authorities:

1. Steel pipe, steel, malleable and cast iron fittings and joining methods; per applicable ASTM/ANSI/ASME standards. In addition, where utilized for potable water service, all elements shall be per applicable NSF and ASTM A53 (for carbon steel) standards.

2. Cast iron pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/CISPI standards.

3. Copper/copper alloy/brass pipe/tube, fittings and joining methods; per applicable ASTM/ANSI/ASME standards. In addition, where utilized for potable water service, all elements shall be per applicable NSF standards.

4. Plastic pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/NSF standards.

D. All Plumbing Contract items/elements shall have the manufacturer's mark or name and the quality of the product or identification of same cast, embossed, stamped or indelibly marked on each item/element in accordance with the standards under which they are accepted and approved per applicable code(s).

E. Connections to existing building utilities shall be made with approved materials of the same type as, or listed for compatibility with, existing materials. Material types to be verified by this contractor in the field in advance of work.

PART 3 EXECUTION

3.01 GENERAL

A. Where standards, codes or guidelines are referenced herein and throughout the Plumbing Contract documentation, including plans and specifications, the latest version/edition shall be applied, unless the Building Code references another version/edition, which shall take precedence.

B. Refer to project documentation furnished with the complete construction package in advance of work for overall coordination and verification of requirements at work of other trades relating to, interfacing with, and/or impacting work in the Plumbing Contract. This includes exact locations, quantities, physical sizes, rough-in details, pipe routing, connection sizes, etc., for items included both in the Plumbing Contract and under separate contract. Coordinate installation and interface requirements with the appropriate contractor(s) in advance of work.

C. Include any minor details, items and/or elements essential to necessary approvals and successful operation in addition to the items specified herein and shown on plans.

D. Where existing items/elements are indicated to be reused as a part of new work, the Plumbing Contractor is responsible for action required to assure that such items/elements will function properly in the completed revised setting, and be in compliance with the requirements of the review, inspection and approval authorities. This includes removal, cleaning and/or reconditioning of items/elements if required.

E. See general "PLUMBING NOTES" on plans for additional conditions and requirements relative to the Plumbing Contract.

F. Plumbing items and elements shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls, surfaces and other

structures through installation, bearing support or subsequent usage of Plumbing items and elements. No framing or other support structure shall be cut, notched or bored in excess of limitations specified in the Building Code, or by the manufacturer of the framing or other support structure, as confirmed in advance of work by the Plumbing Contractor.

3.02 INSTALLATION OF PIPING

A. All piping systems shall be installed with adequate provisions made for expansion and contraction to prevent stresses on piping, valves and equipment. Anchor and guide piping at all points indicated and/or as required. Type and method of anchoring, guiding and attachments to sustaining members to suit job requirements and conditions and shall be approved by the City of Dublin's representative.

B. Provide pipe loops in domestic hot water and re-circulating lines and heating lines where shown on Drawings or required for accurate control of movement. As a minimum, domestic hot water supply and return lines shall not run more than 100 linear feet without a pipe loop or other approved means of expansion control being provided, whether indicated on plans or not.

C. Provide unions or flanges at each final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane and one change of direction in the vertical plane before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of parts and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Pipe unions to be downstream of valves.

D. Provide unions or flanges at each screwed valve, final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane and one change of direction in the vertical plane before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of valves, parts, and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Pipe unions to be downstream of valves.

E. Flange bolts shall be cut to proper length so that one thread projects beyond the nut when nut and bolt are tightened.

F. Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.

G. All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.

H. Provide valves and specialties where indicated on the Drawings.

I. Provide 3/4" drain valves in supply & return piping at low points to provide complete drainage of all systems. Drain valves in potable domestic water lines to include a listed/specified permanently affixed backflow prevention device at the outlet connection point.

J. Ream ends of pipe and clean before installing.

K. All joints in copper piping shall be made with certified/listed “lead-free” solder materials. Solder materials containing lead are prohibited.

L. All joints in underground copper piping shall be brazed.

M. Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.

N. Valves to be installed with hand-wheel at or above center of pipe. Valves outdoors exposed to weather shall be installed with hand-wheel in the horizontal.

O. Valves & other in-line piping operable elements (levers, handles, rising stems, etc.) to be installed in such a manner as to allow full range of operation without restriction or impairment; & without interfering with the operation & access of any & all adjacent elements (structure & work of other trades).

O. Make all changes of direction with fittings, rather than bending.

P. Flanged joints shall be faced true and square. Flanges shall be same face style as mating surface to which it is connected.

Q. Install thermometers and gauges so they may be read from floor level.

R. Install Pete's Plugs as close as possible to control valves, coils, etc., as shown on the Drawings, and arranged so that a probe may be inserted into the plug.

S. All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

T. Where piping is installed in accessible chases, keep all piping to sides of chase, except portions which must necessarily be in center of chase. Offset vents to side immediately above connection to waste line. All lateral runs are to be located at the floor or minimum 6'-0" above floor, and all vertical piping held close to the wall through that height leaving maximum service space.

U. Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel.

V. Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor. Whenever possible, pipe drops in walls to be a single length of pipe or tubing with no or minimal fittings.

W. Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight and provide pan drain to discharge at an approved location. See plumbing notes on plans for additional detail.

X. Properly support all relief valve discharge piping and provide no more than one 90° elbow fitting whenever possible. Where the relief valve discharge from a water heater is extended outside of the room or enclosure where the heater is installed, an air gap fitting shall be provide in the discharge piping within the heater room or enclosure.

Y. Bull head connections in any piping service are expressly prohibited.

Z. At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid

the possibility of any foreign materials entering the pipes during on-going construction, whether it be inadvertent or with malicious intent.

END OF SECTION

SECTION 22 05 10
FIRE-STOPPING

PART 1 GENERAL

1.01 SCOPE

A. This Contractor shall be responsible for fire-stopping at all penetrations of rated structures by work in this contract. Fire-stopping shall be performed by an installer who has been trained & certified by a listed Fire-stopping products manufacturer in the published UL systems installation procedures.

B. Fire-stopping is defined as materials or combination of materials used to retain integrity of fire and/or smoke rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in rated structures including walls & floors.

C. Test Requirements:

1. ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops".

2. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

3. International Fire-stop Council Guidelines for Evaluating Fire-stop Systems Engineering Judgments.

4. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

a. UL Fire Resistance Directory:

i. Through-Penetration Fire-stop Devices (XHCR)
ii. Fire Resistance Ratings (BXUV)
iii. Through-Penetration Fire-stop Systems (XHEZ)
iv. Fill, Voids, or Cavity Material (XHHW)
v. Forming Materials (XHKU)

5. QUALITY ASSURANCE

a. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire-stop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

b. Fire-Stop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

c. Proposed fire-stop materials and methods shall conform to applicable governing codes having local jurisdiction.

d. Fire-stop systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

e. For those fire-stop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Fire-stop Council.

6. SUBMITTALS

a. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL fire-stop systems to be used and manufacturer's installation instructions.

b. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install fire-stop system as described in drawing.

c. Submit material safety data sheets provided with product delivered to job-site.

7. INSTALLER QUALIFICATIONS

a. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire-stopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its fire-stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

8. DELIVERY, STORAGE, AND HANDLING

a. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

b. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

c. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

d. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

e. Do not use damaged or expired materials.

9. PROJECT CONDITIONS

a. Do not use materials that contain flammable solvents.

b. Scheduling

i. Schedule installation of CAST IN PLACE fire-stop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

ii. Schedule installation of other fire-stopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

c. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

d. Weather conditions: Do not proceed with installation of fire-stop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

e. During installation, provide masking and drop cloths to prevent fire-stopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire-stopping under conditions of service and application, as demonstrated by the fire-stopping manufacturer based on testing and field experience.

B. Provide components for each fire-stopping system that is needed to install fill material. Use only components specified by the fire-stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration fire-stop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203
4. Specified Technologies Inc., Somerville, New Jersey, (800) 992-1180
5. Nelson Fire-stop Products, Tulsa, Oklahoma, (918) 641-7299
6. Fox Couplings, Inc., Jacksonville, Florida, (904) 396-2865
7. Proset Systems Inc., Lawrenceville, Georgia, (800) 262-5355
8. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

2.03 MATERIALS

A. Use only fire-stop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place fire-stop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Fire-stop Device
2. Fox Coupling, Inc. "Cast-In-Place Fire-stop Coupling".
3. Proset Cast-In-Place Device
4. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

C. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire-stop Sealant
2. 3M Fire Barrier CP25 or Fire-stop Sealant 2000
3. Tremco Fyre Shield
4. STI LC Latex Endothermic Sealant and SSS Intumescent Sealant
5. Nelson LBS Sealant
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

D. Intumescent sealant or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Fire-stop Sealant
2. 3M Fire Barrier CP25WB+
3. Tremco Intumescent Acrylic or TremStop WBM
4. STI SSS Intumescent Sealant
5. Nelson LBS Sealant
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

E. Fire-stop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 and CP643 Fire-stop Collar, CP645 Wrap Strip
2. Tremco TREMstop D Combustible Pipe Intumescent Device System and TremStop WS Wrap Strip
3. 3M Ultra Plastic Pipe Device and Fire Barrier FS-195+ Wrap Strip
4. STI SSC Fire-stop Collars and Intumescent SSW Wrap Strip
5. Nelson PCS Plastic Pipe Choke System and WRS Wrap Strip
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

F. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowel-able Fire-stop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet
4. STI SSM Fire Rated Mortar and SSB Fire-stop Pillows
5. Nelson CMP Fire-stop Compound and PLW Fire-stop Pillows
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

G. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Fire-stop Pillows
3. 3M CS Intumescent Sheet
4. STI SSB Fire-stop Pillows
5. Nelson PLW Fire-stop Pillows
6. Equivalent products listed in the UL Fire Resistance Directory – Volume 2

H. Provide a fire-stop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which fire-stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by fire-stopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of fire-stopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Fire-stop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place fire-stop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install fire-stop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

C. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

D. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of fire-stopping caused by cutting or penetrating of existing fire-stop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire-stop materials and soiling as work progresses.

END OF SECTION

SECTION 22 05 11
VALVES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary valves for piping systems and equipment in the building required to provide proper shut off, balancing & control of systems included under this Contract.

B. Where valves are installed in potable domestic water piping they shall be listed for such service and in compliance with plumbing code materials and construction requirements.

C. Furnish & install access doors for piping specialties installed within or behind fixed structures such as drywall, plaster, qypsum, concrete, brick, etc. as required for access, maintenance & operation.

PART 2 PRODUCTS

2.01 Gate, globe and check valves shall be Watts, Mueller, Grinnell, Crane, Hammond, Jenkins, Milwaukee, Nibco, Powell or Stockham and shall all be by the same manufacturer.

2.02 Ball valves shall be as manufactured by Apollo or any of the manufacturers listed herein for gate, globe and check valves.

2.03 Butterfly valves shall be as manufactured by Keystone, Center Line or any of the manufacturer's listed herein for gate, globe and check valves.

2.04 Each type of valve (gate, ball, globe, check, etc.) to be by a single listed manufacturer.

2.05 BALL VALVES

A. 2-1/2" size and smaller shall be two-piece bronze body ball valve with threaded connections, teflon seats, conventional port, blowout proof stem, adjustable packing gland, chrome plated bronze ball and lever handle labeled for service controlled. Rated for 150 psig SWP & 400 WOG.

B. Furnish appropriate extensions for lever operators of valves provided with insulation cover.

2.06 Unless indicated otherwise, drain valves shall be bronze construction ball valves as specified herein.

2.07 Check Valves

A. 2-1/2" and smaller - all bronze, horizontal swing check with bronze or TFE disc, screwed, 125 lb. S.W.P.

B. Clow, McAlear, Mueller or Metraflex non-slam check valves are acceptable manufacturers as well as previously listed manufacturers.

2.11 All operable valves indicated to include insulation cover by the plumbing specification shall be provided with control extensions as required for proper access & full range of operation without impairment; or damage to the insulation cover.

PART 3 EXECUTION

3.01 This Contractor shall install all valves in strict accordance to the manufacturer's recommendations.

3.02 Where the Drawings call for both a shut-off valve and a balance valve or fitting, the Contractor may, at his option, furnish a combination balance and stop valve.

3.03 Where drain lines are not piped to floor drains, furnish hose end adapters. Provide cap & chain for all hose end adapters.

END OF SECTION

SECTION 22 05 18
INSERTS, PIPE HANGERS & SUPPORTS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary inserts, beam clamps and auxiliary steel for pipe hangers in the building.

B. Furnish and install necessary pipe hangers and supports to properly support all piping and to maintain uniform elevation.

C. The use of power-driven anchors is expressly prohibited. Power-driven anchors are defined as anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas, or other propellant.

D. Ceiling grid systems shall not be supported from piping or equipment and vice versa. Each utility system and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure. Where interference's occur, provide trapeze type hangers or other suitable supports where they will not interfere with access to valves, equipment & other appurtenances requiring access & service.

PART 2 PRODUCTS

2.01 HANGERS

A. Hangers for direct attachment to copper lines 2" size and smaller shall be similar to Grinnell Figure CT-99 adjustable carbon steel pipe ring with copper plating & support rod.

B. Hangers for direct attachment to copper lines 2-1/2" to 4" size shall be similar to Grinnell Figure CT-65 adjustable carbon steel clevis with copper plating & support rod.

C. Hangers for direct attachment to copper lines 6" size & larger shall be similar to Grinnell Figure 260 adjustable carbon steel clevis with dielectric sleeve/protection & support rod.

D. When copper lines are insulated and hangers are sized for outside of insulation, provide steel hangers as described below.

E. Hangers for steel lines 2" size and smaller shall be similar to Grinnell Figure 97 adjustable galvanized steel band pipe ring with support rod.

F. Hangers for steel lines 2-1/2" size and larger shall be similar to Grinnell Figure 260 adjustable heavy duty carbon steel clevis with support rod.

G Hangers for domestic cold water, storm, vacuum pump exhaust & air compressor intake piping shall be sized for outer diameter of insulation cover run continuous through the hanger. Furnish half-round galvanized sheet metal protectors similar to Grinnell Figure 167 for piping 1-1/4" and larger with run-through insulation cover.

H. Horizontal drain, soil, waste & vent pipe to be supported using Grinnell Fig. 260 adjustable carbon steel clevis with support rod.

2.02 Trapeze hanger assemblies to be listed steel “C” channel similar to Anvil Strut with integrated pipe clamps & all thread support rods. Provide protective grommet/liner for clamp attachment to exposed piping. Support rod sizing to be in accordance with the channel manufacturer’s recommendations for the applicable piping quantities & sizes at each installation.

2.03 Wall brackets to be similar to Grinnell figure no. 195.

2.04 Riser clamps to be similar to Grinnell figure no. 261. Clamps in direct contact with copper piping to be Grinnell figure no. CT-121C with plastic dielectric protection.

2.05 Hanger support rods to be listed all-thread type sized in accordance with the hanger manufacturer’s recommendations for associated piping.

2.06 Clamps & inserts to be listed assemblies provided by the hanger manufacturer for the corresponding support rod size.

2.07 Hangers, supports & accessories as manufactured/provided by Grinnell, B-Line, Michigan, PHD Manufacturing, Anvil or Modern Pipe Hangers may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Pipe clamps shall be provided at each stack & riser structural floor penetration.

3.02 Wall bracket pipe supports shall be installed where required.

3.03 All copper piping is to be shielded from direct contact to steel or other corrosive reaction material of any type with approved dielectric protection.

3.04 Galvanized hangers and strap hangers will not be permitted for supporting copper lines except for hangers sized for outside of insulation.

3.05 Cast iron horizontal soil, drain, waste & vent pipe to be supported at each joint (hub side of hub & spigot piping), each p-trap, within (4) linear feet of each 90 degree change of direction (including vertical drops), base of each riser, at each floor penetration and elsewhere as required. Piping shall be installed according to the pipe manufacturer’s specifications & recommendations including support & restraint. Piping 6” size & larger shall have sway bracing provided at each hanger, and rod & clamp restraints provided for couplings at each branch connection & change of direction. No-hub piping 12” size & larger in ten foot lengths shall have hangers provided on both sides of each coupling.

3.06 Steel & copper piping to be supported according to the following schedule. Support at intervals not to exceed spacing listed or elsewhere as required in accordance with good workmanship. No pipe shall be supported from another pipe. All hangers shall be plumbed before insulation is applied and all hangers shall be double-nutted:

Steel Pipe			Copper Pipe		
Pipe Size	Rod	Spacing	Pipe Size	Rod	Spacing
Thru 1"	3/8"	7'0"	Thru 3/4"	3/8”	6'0"
1-1/4"	3/8"	9'0"	1"	3/8”	7'0"
1-1/2"	3/8"	9'0"	1-1/4"	3/8”	9'0"
2"	3/8"	10'0"	2"	3/8”	9'0"
2-1/2"	1/2"	11'0"	2-1/2"	1/2”	11'0"
3"	1/2"	12'0"	3"	1/2”	11'0"
4"	5/8"	14'0"	4"	5/8”	11'0"
6"	3/4"	17'0"	6"	3/4”	14'0"
8"	7/8"	19'0"	8"	7/8”	14'0"
10"	1"	22'0"			
12"	1"	23'0"			

3.07 Support plastic supply pipe at intervals not to exceed 4 feet, 6 feet on 4 inch and larger.

3.08 Support piping at pumps and equipment from floor, ceiling, or walls, so that piping weight is not supported directly from pumps or equipment.

3.09 All hangers shall be double-nutted.

END OF SECTION

SECTION 22 05 20
CUTTING & PATCHING

PART 1 GENERAL

1.01 SCOPE

A. Cutting for all openings in structures, framing or other elements required for installation of work in this contract shall be done by this contractor with appropriate tools and methods as to prevent unnecessary damage to surrounding areas or equipment.

B. Unless indicated otherwise patching for all openings left in structures after existing plumbing elements have been removed shall be done by this contractor to match adjacent structure in type, kind & finish.

PART 2 PRODUCTS

2.01 Patching & repair of structural elements to be done with listed compatible materials & methods in accordance with general contract conditions for specific types of structure when applicable.

PART 3 EXECUTION

3.01 Avoid cutting of concrete, masonry and other new work by the use of inserts and sleeves.

3.02 All holes in existing walls and floors shall be cut by use of core drills, using water to keep down the dust, and a method for catching water shall be provided. In addition, a vacuum cleaner shall be used with inlet as close to the hole being drilled as possible to pick up all dust caused by drilling.

3.03 The corners of all openings in poured concrete shall be core drilled to minimize over-cutting.

3.04 Fill and patch openings left by removal of piping and equipment in this contract to match adjacent surfaces.

3.05 Openings in rated structures shall be filled or patched in such a manner as to maintain the appropriate rating including fire-stopping if necessary.

3.06 The Protection of Persons and Property Section of the General Conditions must be followed without exception, including precautions against Fire Hazards.

3.07 No structural member will be cut without the expressed permission of the City of Dublin's representative obtained in advance.

END OF SECTION

SECTION 22 05 31
FLUSHING & STERILIZATION

PART 1 GENERAL

1.01 SCOPE

A. Flush out all domestic water piping systems to remove all dirt and grease from pipes and equipment before systems are placed into operation. Clean strainers after each flushing until the strainer remains clean.

B. After domestic water lines are all installed, sterilize lines, including outside services as prescribed by AWWA-C-651. Sterilization shall be done under the immediate on the job supervision of a water testing laboratory regularly engaged in the service and shall be done per their instructions. All fees for testing and test equipment shall be paid by this Contractor.

C. Furnish a Certificate of Sterilization and Approval For Human Consumption signed by a Professional Engineer registered in the State of Ohio regularly in the employ of the Testing Laboratory. Certification shall be furnished to the City of Dublin's representative before payment will be made.

D. Sterilization method shall be approved by the authority having jurisdiction, and shall follow the procedures described in AWWA C651 or AWWA C652, or as listed in the Ohio Plumbing Code, Chapter 6.

PART 2 PRODUCTS

2.01 Sterilization: Chlorinating material either liquid chlorine meeting AWWA Standard B30l, sodium or calcium hypochlorite meeting AWWA Standard B300.

PART 3 EXECUTION

3.01 With all outlets closed, fill system to working pressure and close valve at supply main.

3.02 A cleaning solution containing not less than 150 parts per million of chlorine shall be introduced into the system.

3.03 Each outlet, hot and/or cold, shall be tested during fill to prove the presence of chlorine at that outlet and valves and faucets shall be opened and closed several times during the disinfecting time period.

3.04 Water piping systems shall remain filled for a period of 24 hours and each outlet shall be again tested and shall produce <u>not</u> <u>less</u> than 100 parts per million of chlorine at the end of the retention period.

3.05 All outlets shall be opened wide and the main supply valves opened, flushing system with water until chlorine content is <u>not</u> <u>greater</u> than 0.2 parts per million or until approved by the Health Department. Flush drain valves.

3.06 After final flushing all aerators on plumbing brass shall be removed, cleaned and reinstalled.

3.07 Sterilization test may be performed at the same time the pressure test is placed on the system.

END OF SECTION

SECTION 22 05 50
DEMOLITION

PART 1 GENERAL

1.01 SCOPE

A. This Contractor shall be responsible for removal of and modifications to the existing plumbing installation including equipment, fixtures, piping & other elements as herein noted and as shown on the Drawings. Unless indicated otherwise all elements removed and not reused in remodeling shall become the property of this Contractor and be promptly removed from the site.

B. Relocate pipe and equipment as needed for new Fire Suppression, HVAC, and Electrical work, as directed by the Construction Manager. All Work shall be in accordance with the specifications and the Ohio Plumbing Code.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 Unless indicated otherwise this contractor shall be responsible for removing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the plumbing installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.

3.02 All waste materials associated by the demolition process shall be removed & clean-up performed by this contractor in accordance with general conditions of construction.

3.03 All work in this contract to be done in such a manner as to maintain or minimize interruption of plumbing utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.

3.04 Any plumbing systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the City of Dublin's representative.

END OF SECTION

SECTION 22 05 51
REMODELING

PART 1 GENERAL

1.01 SCOPE

A. This Contract shall include revisions to all plumbing work in the remodeled portions of the building necessitated to properly integrate with & function within the finished remodeled structure. The remodeled areas shall be as indicated by the Architectural and Plumbing Drawings

B This Contract shall include the removal & re-installation of existing plumbing equipment, and re-routing, re-installation & re-connection of associated piping. All de-activated plumbing fixtures, equipment & piping not utilized in the remodeled structure shall be removed.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 REMODELING

A. In all of the remodeling work the plumbing work shall follow the intent of the Plumbing Specification insofar as possible with regard to material and workmanship.

B. Where an existing plumbing fixture or piece of equipment is removed & re-set at the same location this contractor shall provide new traps, trap arm piping, stops, risers & piping wall escutcheons in accordance with the specification for new elements of comparable type.

C. Unless indicated otherwise, floor drains indicated to be removed in floor structures that are to remain shall have associated piping removed back to active mains & capped. The floor drain grate shall be removed & discarded, the outlet plugged & the body filled with non-shrink grout flush to structural floor surface. Where these floor drains are in slab on grade construction the piping between the plugged outlet & the cap at active main may be abandoned in place, unless this piping obstructs the installation of new work of any trade in which case the obstructing portion shall be removed.

D. Where existing structures (including soffits & fur-outs) are removed any exposed plumbing piping that is to remain active & in use on completion of the project shall be offset to the nearest available concealing structure (new or existing) and reconnected as necessary or required, using all new material for the offset. Note that this shall include piping of every description within the plumbing scope of work at both known and unknown locations.

E. Unless indicated otherwise, all piping installed in the remodeling work in finished areas shall be installed as concealed work. This Contractor shall do all cutting & repair of structures as required.

F. Existing plumbing fixtures or equipment installations that are to remain upon project completion but which interfere with the remodeling work of this or any other project contractor shall be removed & re-installed by this contractor. Existing traps, stops risers & branch arm drain piping may be re-used. Scheduling of fixture or equipment removal & re-installation shall be coordinated with any & all contractors affected & the City of Dublin's representative.

3.02 Unless indicated otherwise this contractor shall be responsible for repairing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the plumbing installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.

3.03 All waste materials associated with the remodeling process shall be removed & clean-up shall be performed by this contractor in accordance with general conditions of construction.

3.04 All work in this contract to be done in such a manner as to maintain or minimize interruption of plumbing utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.

3.05 Any plumbing systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the City of Dublin's representative.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 GENERAL

1.02 SCOPE

A. Provide listed insulation cover for all items/elements as specified herein, as shown on plans; and for any other items/elements requiring same.

B. Insulate piping and associated accessories and appurtenances included in the following systems:

1. Domestic cold water.
2. Domestic hot water.
3. Domestic hot water return.
4. Horizontal Storm Piping.
5. Sanitary piping receiving condensate.

C. Existing piping insulation removed or damaged by new work shall be replaced in accordance with these specifications for new piping of the same system type. This includes hazardous abatement insulation removal, see specifications for scope.

D. Where new insulation cover connects to existing, provide approved transition elements as required for proper integration in a clean, continuous manner.

PART 2 PRODUCTS

2.01 All insulating materials, including jackets, cements, adhesives, vapor barriers, etc., shall be U.L. listed, with a flame spread rating not to exceed 25, and a smoke development rating not to exceed 50. All exterior finishes shall have a minimum service temperature limit (FSTM 70) of minus 50 to 220 degrees F.

2.02 Molded plastic fitting covers shall be U.L. listed, with a flame spread rating not to exceed 25, and a smoke development rating not to exceed 50.

2.03 Insulation thicknesses are based on insulation having thermal resistance in the range of 4.0 HR F ft^2/Btu to 4.6 HR F ft^2/Btu per inch of thickness on a flat surface at a mean temperature of 75°F. Minimum insulation thickness shall be increased for materials having R values less than 4.0 or may be reduced for materials having R values greater than 4.6 to give equivalent "R" values.

2.04 Fiberglass insulation pipe cover shall be similar to Johns Manville "Micro-Lok", rated for 850 degrees F., with a factory applied AP-T all-purpose self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide, and of same material as jacket. Equal materials, including thickness and conductivity ratings/listings, as manufactured by Owens Corning, Knauf or Manson may be furnished, at the contractor's option.

2.05 Where insulation thickness is indicated for cover herein, it is the nominal MINIMUM required thickness.

2.06 For fiberglass cover, all cements, adhesives, finishes, and associated materials shall be similar to that provided by Foster. Equal materials as provided by Childers or Vimasco may be furnished at the contractor's option.

PART 3 EXECUTION

3.01 Provide fiberglass cover for cold water piping, horizontal storm piping, and sanitary piping receiving condensate as follows:

A. Cover with minimum 1/2" thickness insulation.

B. Butt all edges of insulation and seal all longitudinal laps and butt strips with white vapor barrier cement, similar to Foster no. 85-20; or furnish with manufacturer's integral self-sealing laps.

C. Fittings and mechanical couplings shall be wrapped with compressed fiberglass to same thickness and density as adjacent pipe covering, and covered with a listed molded plastic fitting.

D. All appurtenances and accessories such as valves, flanges, unions, etc. installed in referenced piping (with the exception of backflow prevention assemblies) shall be wrapped with full thickness insulation and covered with a listed molded plastic fitting cover; or an open mesh glass cloth shall be applied over wet mastic, and covered with a second coat of fire resistant mastic. Backflow prevention assemblies which require periodic inspection/testing/maintenance shall not be provided with insulation cover, unless these assemblies are in water sensitive locations, such as above lay-in ceilings. If listed backflow prevention assemblies are in water sensitive locations, furnish cover complying with this specification that allows removal and replacement as necessary for required access. Insulation cover at valves & other operable components shall be done in such a manner as to allow proper access & full range of operation.

E. Use 12" long sections of calcium silicate rigid insulation, with jacket same as adjacent pipe covering for transfer of support to piping at each hanger, without stress to the pipe covering assembly. At the contractor's option, an approved wood or high-density (20 lb./cubic foot) fiberglass block may be substituted for the rigid insulation section. Vapor barrier to be maintained throughout.

3.02 Provide fiberglass cover for hot water, hot water return & tempered water piping as follows:

A. Cover with minimum 1" thickness insulation.

B. Butt all edges of insulation and seal all longitudinal laps and butt strips with white vapor barrier cement, similar to Foster no. 85-20; or furnish with manufacturer's integral self-sealing laps.

C. Fittings and mechanical couplings shall be wrapped with compressed fiber glass to same thickness and density as adjacent pipe covering, and covered with a listed molded plastic fitting.

D. All appurtenances and accessories such as hangers, valves, flanges, unions, etc. installed in referenced piping shall not be covered. Cover shall be interrupted to allow direct hanger support of referenced piping. All insulation cover termination points shall be stopped with an even flat surface perpendicular to piping, sealed with Foster "Tight-Fit" coating.

3.03 All applications shall be made on clean, dry surfaces with all joints butted firmly together.

3.04 Insulation must run continuous through hangers, sleeves and walls for all cold water piping.

3.05 On all piping 1 ¼" diameter and larger with insulation cover specified to run continuous through hanger assemblies, provide a listed/approved sheet metal protective insulation shield at each hanger.

3.06 Insulation shall not be applied until general construction has progressed sufficiently to minimize potential for physical or moisture damage to the cover assembly. All damaged cover shall be replaced at the contractor's expense.

3.07 Install protective sleeve as specified in Section 22 05 15, "Sleeves and Collars", on all insulated, exposed pipes penetrating floor structure.

3.08 Hanger rods must be perpendicular before insulation is installed.

3.09 Longitudinal lap joints and butt strips for fiberglass piping insulation shall be secured with staples on three (3) inch centers, and sealed with an approved vapor barrier adhesive where applicable. Staples are not required when insulation utilizes a "double" adhesive self-sealing system.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. Connect to existing domestic water supply and return mains within the structure at the location(s) indicated on plans, and provide a complete domestic water supply piping system as shown on plans, and as necessary to serve all items/elements requiring same.

B. The domestic water piping system shall include, but not be limited to the following:

1. Cold water supply
2. Hot water supply and return
5. Trap primer supply

C. All elements specified herein and/or indicated on plans with components/parts in contact with the potable water medium shall be listed for such service, in accordance with referenced code requirements.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Above ground piping up to and including 6” size:

1. Type L hard drawn copper tube with wrot copper fittings and socket solder joints and connections. 3” & larger size joints & fittings to be brazed. Tee drill mechanical saddle connections may be utilized for branch take-offs, provided they are listed/approved extruded type, in compliance with the requirements of all review, inspection and approval authorities, confirmed by the Plumbing Contractor in advance.

B. Solder, flux and all other pipe joining materials shall be certified "lead free" and listed for use with potable water service.

2.02 SHOCK ABSORBERS

A. Similar to Zurn Shocktrol series Z-1700, sized and installed as recommended by the manufacturer for specific conditions at each location.

B. Equal shock absorbers as manufactured by Zurn, Mifab, J.R. Smith, Josam, Sioux Chief or Precision Plumbing Products may be provided at the contractor's option.

2.03 TRAP PRIMER ASSEMBLIES; as specified on plans, unless indicated otherwise.

A. Equal trap primer assemblies as manufactured by Zurn, J.R. Smith, Josam, Precision Plumbing Products, Wade, Sloan, Mifab or Sioux Chief may be furnished at the contractor's option.

2.05 PRESSURE REDUCING/REGULATING VALVES

A. Low flow capacity or individual fixture/equipment service shall be direct acting diaphragm type bronze construction pressure reducing valve similar to Watts model no. U5LP with integral inlet strainer, outlet pressure gauge, internal thermal expansion bypass, adjustable outlet pressure range and threaded connections rated for 175 psig working pressure. Valve to be rated for maximum 180 degrees F. temperature service. Assembly to be listed in accordance with ASSE 1003 standards.

B. Moderate flow range and/or multiple simultaneous use fixtures/equipment service shall be direct acting diaphragm type bronze construction pressure reducing valve similar to Watts model no. 223 with adjustable outlet pressure range and threaded connections rated for 175 psig working pressure.

C. Broad flow range (minimum/maximum) and/or multiple non-simultaneous use fixtures/equipment service shall be hydraulically operated pilot controlled diaphragm type iron body valve similar to Cla-Val Co. 90G-01AJ series with bronze fittings, adjustable outlet pressure range and threaded connections rated for 175 psig working pressure.

D. Assemblies shall be furnished with adjustable position inlets and outlet. Flow capacities, outlet pressure setting and inlet/outlet pressure differential as indicated on plan. Provide assemblies as required to operate properly with pressure differential as indicated.

E. Equal pressure reducing/regulating valve assemblies as manufactured by Watts, Cla-Val Co., Wilkins, Febco, Ames, Anderson, Watrous or Conbraco may be furnished at the contractor's option.

2.06 BACKFLOW PREVENTORS

A. Reduced pressure principle backflow preventer shall be Wilkins 575 RP Series reduced pressure principle backflow preventer type, size as shown on the Drawings. It shall be a complete assembly including tight- closing shut-off valves before and after the device. Valve shall be protected by a strainer unless the manufacturer provides a guarantee that valve will work properly (not plug up) without a strainer. Backflow preventer shall include test cocks and pressure-differential relief valve located between two positive seating check valves. Provide with threaded connections for sizes 2” and smaller, 150 class flange connections for sizes 2-1/2” and larger. Furnish backflow preventer with a Wilkins AG Series fixed air gap secured to relief vent. Backflow preventer by Clayton, Febco, Aero, Lawler, Hersey or Watts using reduced pressure principle may be furnished at the Contractor's option.

C. Pressure type in-line vacuum breaker assemblies shall be similar to T & S model no. B-0963 anti-siphon/anti-spill type with bronze construction, isolation valves, test cocks, check assemblies, wall/panel escutcheons and maximum 180 degrees F. temperature rating. Size as indicated by piping size where installed on plans. Assembly to be rated for 125 psig working pressure. All components exposed in finished areas to be provided with polished chrome finish, including vacuum breaker, piping and wall/panel escutcheons.

G. At all hose thread outlet connections to the domestic water supply system not furnished with an integral backflow prevention device, provide an vacuum breaker similar to Watts model no. NF8 permanently affixed, with ¾” hose thread connection at outlet.

H. Unless indicated otherwise, backflow prevention assemby size as indicated by piping size where installed on plans. Equal assemblies as manufactured by Watts, Zurn, Wilkins, Febco, Conbraco, Hersey, Ames or Lawler may be furnished at the contractor's option.

PART 3 EXECUTION

3.01 All piping that supplies a flush valve, solenoid valve (other than slow-closing type), foot pedal operator, spring return operator or other quick closing type device shall have a shock absorber installed in accordance with the manufacturer's recommendations. Unless indicated otherwise, where multiple fixtures or equipment in adjacent locations (such as within a chase or other enclosure) are supplied by common piping manifold, a properly sized and installed shock absorber may be utilized.

3.02 Run all water piping level and conceal wherever possible. Piping to be installed to allown complete drain down of system back to main riser(s) at base of system whenever possible. Provide ¾" drains at base of riser(s), and any other trapped or low points when such are unavoidable due to project conditions. ¾" Drains to consist of ball valve with outlet connection vacuum breaker as specified herein.

3.03 Install an in-line pressure type vacuum breaker as specified herein in the individual/dedicated supply piping for all valves, fittings, trim or other elements with serrated ends or other outlets capable of hose connection that do not include an integral listed/approved backflow prevention device.

3.04 Balance recirculating branch line flows as required for proper operation of systems. Provide combination balance/shut-off valves, check valve, thermometer and Pete's plugs for each branch recirculating line.

3.05 Coordinate installation with structure, site conditions and work of other trades at and adjacent to domestic water service piping installation.

3.06 Maintain necessary clearance from structural support elements as required for installation of domestic water service piping outside of support/bearing zones.

END OF SECTION

HVAC SPECIFICATIONS - INDEX

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23 82 39.16	Horizontal Projection Unit Heaters
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SECTION 23 00 00

GENERAL - HVAC

PART 1 GENERAL

1.01 SCOPE

A. Sections 23 01 00 thru 25 00 00 (as included), contain material of a general nature and apply to all work performed under Division 23. The HVAC Contractor shall conform to all provisions as included and is to consider the word "Contractor" to mean themselves.

B. Carefully coordinate scope of work with the A/E and the City of Dublin prior to submitting bids. All work required to provide a complete and operational system for all items described in the Construction Documents, including items furnished under the Phase 1 project, are the responsibility of this contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 23 01 05
HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 REFERENCE

A. The Contractor for this work is referred to Instructions to Bidders, General Conditions and Division 1 - General Requirements, as a part of this Contract.

1.02 GENERAL REQUIREMENTS

A. Refer to the Instructions to Bidders and to General Conditions for scheduling, pre-bid meetings, site visits prior to bidding, questions/RFIs, subcontractor/material declaration procedures, material hoisting, cleaning, coordination, service interruption, and other general conditions.

B. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete HVAC system, ready to operate, including but not limited to the items listed under the HVAC Specification Index.

C. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of their work with work performed under all other Contracts.

D. The Contractor should feel free to contact the A/E immediately if there is any question regarding the meaning or intent of either Plans or Specifications, or if they notice any discrepancies or omissions in either Plans or Specifications.

E. Other than minor adjustments shall be submitted to the A/E for approval before proceeding with the work.

1.03 DRAWINGS

A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.

B. Piping and duct layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and ductwork to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in the HVAC Contractor's Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the A/E.

D. The A/E reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the City of Dublin.

E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in the HVAC Contractor's Bid Price.

F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to the City of Dublin.

G. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between ductwork, piping, etc. and the ceiling.

H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

I. See General Conditions for additional coordination drawing requirements.

1.04 PERMITS, INSPECTIONS AND CODES

A. Refer to the General Conditions for Contractor responsibilities regarding permits. The A/E will obtain the general building permit.

B. Submit Qualification Certificate for each welder to the A/E before such welder starts work.

C. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:

1. Ohio Building Code, Department of Industrial Relations, State of Ohio.

2. Specific Safety Requirements Relating to Building and Construction Work, Industrial Commission and Department of Industrial Relations, State of Ohio.

3. Specific Safety Requirements Covering the Installation of Pressure Piping Systems, Industrial Commission and Department of Industrial Relations, State of Ohio.

4. Ohio Pressure Piping Systems Rules, Ohio Board of Building Standards and Department of Industrial Relations, State of Ohio.

5. A.S.M.E. Pressure Piping Code - Section B31.1

6. National Electrical Code, Bulletin No. 70, National Fire Protection Association.

7. Air Conditioning and Ventilating, Bulletin No. 90 A, National Fire Protection Association.

8. Life Safety Code, Bulletin No. 101, National Fire Protection Association.

9. All Work Under Jurisdiction of Local Fire Marshal shall conform to requirements set forth by Fire Marshal's Office and National Fire Protection Association.

D. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.

E. When the work is completed, the Contractor shall furnish the A/E a Certificate of Inspection and Approval from the State of Ohio Board of Health before final payment of the Contract will be allowed.

1.05 ENERGY CODE

A. The HVAC System must comply with all requirements of ASHRAE Standard 90.1-2007 "Energy Standard for Buildings Except Low-Rise Residential Buildings". This includes, but is not limited to, efficiencies, power factors, insulation thickness, etc.

1.06 UTILITIES

Not applicable to the HVAC scope of work for this project.

1.07 OPERATING AND MAINTENANCE INSTRUCTIONS

A. This Contractor shall thoroughly instruct and supervise the City of Dublin's maintenance personnel in the proper operation and maintenance of the mechanical system equipment. This Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the City of Dublin or their representative and for notifying the A/E of the time at least 48 hours in advance. Refer to Division 01 for additional requirements.

1. Instructions shall include the following:

a. Location of equipment and explanation of what it does.

b. Reference to "Operating Instruction Manuals" for record and clarity.

c. Coordination of written and verbal instruction so that each is understood by all personnel.

d. Explanation of the temperature control system including panels.

e. Specific maintenance to be performed by the City of Dublin.

B. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. Submit preliminary copy 45 days following the receipt of all approved shop drawings. After final approval, provide four (4) copies of Operation and Maintenance Instructions for submittal to the City of Dublin. Final copies shall be submitted 30 days prior to training. (See Division 01 for additional requirements.) Instructions shall consist of the following items:

1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Construction Manager, name of A/E, name of A/E.

2. Second Page: Index of Manual Contents.

3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.

4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.

6. Complete wiring diagrams for the mechanical systems as actually wired including control and interlock wiring.

7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.

8. Routine and 24-hour emergency information:

a. Name, address and telephone number of servicing agency.

b. Include names of personnel to be contacted for service arrangements.

C. Frame one (1) copy of brief start-up, shut-down and routine maintenance instructions and complete system wiring diagrams under glass and mount on the Equipment Room wall. Temperature Control schematics may be laminated with plastic at the Contractor's option.

1.08 AS-BUILT DRAWINGS

A. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications as required by the General Conditions.

B. Submit As-Built documents as required by General Conditions. See Division 01 for additional requirements.

1.09 SUPERVISION

A. This Contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

1.10 UNACCEPTABLE WORK AND OBSERVATION REPORTS

A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

B. The Contractor shall promptly correct all work found unacceptable in accordance with the General Conditions.

1.11 FINAL INSPECTION

A. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall proceed as required under the General Conditions.

1.12 GUARANTEE

A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year and as required by the General Conditions.

B. Provide an extended warranty for all equipment used for temporary HVAC during construction.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 23 01 10
MANUFACTURER'S DRAWINGS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall submit to the A/E for review, within three weeks after date of contract, one hared copy and one electronic (PDF format copy) of manufacturer's drawings, wiring diagrams, pump curves, fan curves and other pertinent submittal data. The A/E will review Contractor's shop drawings and related submittals (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the A/E. Before submitting a shop drawing or any related material to the A/E, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, operations of construction, and safety precautions and programs incidental thereto; all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The A/E shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises A/E otherwise via a written instrument, which is acknowledged by A/E in writing. The shop drawings and related material (if any) called for are indicated below:

<u>Heating, Ventilating and Air Conditioning Contract</u>

Fire Stopping
Piping Specialties
Valves*
Vibration Isolation/supports/Hangers
Tagging and Identification for pipe and equipment
Test Procedures
Insulation for Equipment, and Piping
Commissioning – Startup and Functional Testing per Manufacturer
Condenser Water Piping (above ground and underground)
Geothermal Water Piping (above ground and underground)
Louvers
Electric Unit Heaters
Plate-and-Frame Heat Exchangers
Geothermal Well Pumps and VFDs
Geothermal Well Drilling procedures
Geothermal Well Casings
Directional Bore process and procedures
HVAC System Controls*
* - provide attic stock list of belts, filters, or other maintenance items

B. The A/E shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by the Contractor as indicated above. The A/E shall return without comment material not called for or which has not been approved by the Contractor.

C. This Contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are <u>NOT ACCEPTABLE</u>.

D. The manufacturer shall provide a statement on all submittals that the equipment furnished complies with the Energy Code. This relates to high efficiency motors, EER's, COP's, etc.

E. This Contractor is to provide 1/4" scale plots, PDF files, and CAD files (or Revit files) of the piping and sheet metal drawings for use in coordinating the Plumbing, Fire Protection and Electrical work with the layout of air distribution systems and related work. Lighting, ceiling grid and all ceiling access doors shall be shown lightly to verify coordination. All dampers and valves shall be shown on the coordination drawings. HVAC Contractor to provide initial plots within 20 days of award of contract. Each Prime Contractor is responsible for overlaying their work onto these sepias; for providing information as to size, elevation and location proposed for all components; and for coordination of their work with that of other Contractors. Final resolution of all items to be determined at project meetings held by the Construction Manager, with input from the A/E.

F. A/E's review of manufacturer's drawings or schedules shall not relieve the Contractor from compliance with the requirements of the plans and specifications.

G. Refer to the applicable Division 1 and General Conditions, including Article 13, “Action Submittals”, for additional information.

1.02 QUANTITIES

A. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 23 05 13

ELECTRICAL WORK

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 01 05 - ENERGY CODE paragarph

B. Section 23 75 00 - AIR HANDLING UNITS

C. Section 23 90 00 – VARIABLE FREQUENCY DRIVES.

D. Section 25 00 00 - BUILDING AUTOMATION SYSTEM

E. Division 26 – ELECTRICAL

1.02 SCOPE

A. This Contractor shall furnish all motors for HVAC equipment. Motor starters, safety switches and wired junction boxes shall be furnished and installed by the Electrical Contractor except where explicitly specified to be furnished with certain mechanical equipment.

1.03 WORK INCLUDED - HVAC CONTRACTOR:

A. Temperature Control wiring by Temperature Control Contractor (Sub-Contract to the HVAC Contractor) except as noted below by Electrical Contractor.

B. 120 volt wiring required for mechanical equipment when not shown or specified elsewhere.

1.04 WORK INCLUDED - ELECTRICAL CONTRACTOR.

A. All power wiring.

B. All conduit and wiring incidental to HVAC system controls, including switches, controls, transformers and relays shall be by the Temperature Control Contractor, except wiring specifically indicated on the Electrical Drawings to be by the Electrical Contractor.

C. Motor starters, contactors, and disconnects where noted under "PRODUCTS" below.

D. Electrical Contractor shall provide 120 volt control power to a wired junction box near the Temperature Control Cabinets. Final connections to be made by the Temperature Control Contractor.

1.05 SHOP DRAWINGS:

A. The Contractor shall furnish to the Electrical Contractor, equipment shop drawings which will indicate power hook-up and control connections as required for mechanical equipment. "Stock" Wiring Diagrams are Not Acceptable.

B. Prepare as a part of the HVAC control shop drawings, complete terminal-to-terminal wiring diagrams. These shall show terminal designations on control items and equipment. Wiring diagrams to be compatible with Electrical Drawings.

PART 2 PRODUCTS

2.01 Refer to Division 26 - ELECTRICAL.

2.02 Refer to Section 23 01 05 - Paragraph 1.05 for "Energy Code" requirements (Particularly power factor correction).

2.03 All single-phase motors provided by this Contractor to have built-in thermal overload protection.

2.04 Motor starters, contactors, and disconnects are provided and installed by the Electrical Contractor, unless part of packaged equipment furnished by this Contractor, or otherwise specified.

2.05 All motors 1/2 HP and larger shall be three phase; all motors, 1/3 HP and smaller shall be single phase unless specified otherwise.

2.06 All motors furnished shall have copper windings and all motors five (5) horsepower and greater shall have factory installed lifting eyebolts. All motors shall conform to ANSI and NEMA standards.

2.07 All motors used in variable speed applications shall be high efficiency type and shall be rated for use with variable frequency drives.

PART 3 EXECUTION

3.01 All wiring, conduits, etc., shall be in strict accordance with the requirements of the latest edition of the National Electrical Code and Division 26, Electrical specification.

3.02 All wiring, including low voltage wiring, shall be run in conduit, unless noted otherwise in the Building Automation System specifications.

3.03 Low voltage wiring may be size and type recommended by the Manufacturer and/or Temperature Control Contractor.

END OF SECTION

SECTION 23 05 16
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Flexible-hose packless expansion joints.
2. Metal-bellows packless expansion joints.
3. Pipe loops and swing connections.
4. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide 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. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections. Include stress analysis of all new pipe runs installed outside the building foundation (in utility tunnel and below grade at 19th Ave).
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Metraflex, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing 2 inches and Smaller: Copper-alloy fittings with solder-joint end connections.

   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.

5. Expansion Joints for Copper Tubing over 2 inches: Copper-alloy fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.

6. Expansion Joints for Steel Piping 2 inches and Smaller: Carbon-steel fittings with threaded end connections.

   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.

7. Expansion Joints for Steel Piping over 2 inches: Carbon-steel fittings with flanged end connections.

a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.

B. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American BOA, Inc.
   b. Badger Industries, Inc.
   c. Expansion Joint Systems, Inc.
   d. Flex-Hose Co., Inc.
   e. Flexicraft Industries.
   f. Metraflex, Inc.
   g. Unisource Manufacturing, Inc.
   h. U.S. Bellows, Inc.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 175 psig unless otherwise indicated.
5. Configuration: Single joint with base class(es) unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
7. End Connections for Copper Tubing 2 inches and Smaller: Solder joint.
8. End Connections for Copper Tubing over 2 inches Solder joint or threaded.

9. Expansion Joints for Steel Piping: Single- or multi-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

   a. End Connections for Steel Pipe 2 inches and smaller: Threaded.
   b. End Connections for Steel Pipe over 2 inches: Flanged.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Thermal Systems, Inc.
   b. Flex-Hose Co., Inc.
   c. Flexicraft Industries.
   d. Hyspan Precision Products, Inc.
   e. Metraflex, Inc.
   f. Senior Flexonics Pathway.
   g. U.S. Bellows, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.

2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

    a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guides on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

SECTION 23 05 17

FIRESTOPPING

PART 1 GENERAL

1.01 SCOPE

A. Each Contractor shall be responsible for firestopping around all openings for pipes, ducts, conduits, etc., installed by them at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL REQUIRMENTS

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Through-Penetration Firestop Devices (XHCR)

b. Fire Resistance Ratings (BXUV)

c. Through-Penetration Firestop Systems (XHEZ)

d. Fill, Voids, or Cavity Material (XHHW)

e. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems A/Eing Judgments

D. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

E. The Ohio Building Code (OBC)

F. NFPA 101 - Life Safety Code

1.04 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural A/E prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's A/Eing judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. A/E judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

1.05 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.06 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.08 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that is needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
2. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
3. Proset Cast-In-Place Device

C. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25 or Firestop Sealant 2000
3. Tremco Fyre Shield

D. Sealant or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601S Elastomeric Firestop Sealant or CP 606 Flexible Firestop Sealant
2. Tremco Fyre-Shield High Performance Ceramic Firestop Sealant
3. 3M Fire Barrier CP25WB+ or 2000 Silicone Sealant

E. Intumescent sealant or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25WB+
3. Tremco Intumescent Acrylic or TremStop WBM

F. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 and CP643 Firestop Collar, CP645 Wrap Strip
2. Tremco TREMstop D Combustible Pipe Intumescent Device System and TremStop WS Wrap Strip
3. 3M Ultra Plastic Pipe Device and Fire Barrier FS-195+ Wrap Strip

G. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet

H. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Firestop Pillows
3. 3M CS Intumescent Sheet

I. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical A/E and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. All penetrations are to be labeled in accordance with the City of Dublin's standard labeling system. The HVAC Contractor shall coordinate all fire stopping requirements with the City of Dublin prior to start of work.

B. Keep areas of work accessible until inspection and approval have been completed.

C. All fire stopping shall be inspected and approved by a licensed independent Consultant. All unapproved fire stopping products installed by this contractor will be removed and replaced at the HVAC Contractor's expense.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 23 05 19
PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary piping specialties to include thermometers, Pete's Plugs, etc., for piping systems included under this Contract.

PART 2 PRODUCTS

2.01 Thermometers - Trerice – mercury-free red-reading-in-glass type with 9" magnified column, Fahrenheit scale, recalibration feature, adjustable head and brass separable socket. Thermometers shall be provided with remote head where required. Ashcroft, Marsh, or Weiss of the same type may be furnished at the Contractor's option. Ranges as shown on the Drawings.

2.02 Pressure Gauges – Weiss, stainless steel case, 4-1/2" diameter single spring type with recalibration adjustment in the dial face and with gate valve shut-off. Provide remote gauge where required. Ranges as indicated on Drawings. Trerice, Marsh or Ashcroft of the same type may be furnished at the Contractor's option. All gauges shall be glycerin filled.

2.03 Pete's Plug -

A. 1/4" MPT fitting to receive either a temperature or pressure probe, 1/8" O.D. fitting and caps shall be brass with valve core of Nordel, rated at 1000 psig.

B. Provide XL (extra long) type Pete's plug in insulated lines.

C. Sisco plugs may be furnished at the Contractor's option.

2.04 Strainers

A. All water lines - Sarco style IF-125 (flanged) or IT (threaded) 125 psig, Y-pattern, cast iron body with perforated brass screen for water. Threaded for 2-1/2" and smaller, flanged for 3" and larger.

B. Dunham-Bush, Armstrong, Trane, McAlear, Mueller, Metraflex, Wheatley or V. D. Anderson strainers may be furnished at the Contractor's option.

2.05 Flexible Vibration Joints

A. Flexible connectors shall be Hose Technology Model HTF, pipe size as shown on Drawings. Connector shall be hose and braid type with type 316 stainless steel hose and type 304 stainless steel braid. Connector shall be suitable for pump suction and discharge mounting and designed for minimum of 125 psig working pressure and 220°F operating temperature.

B. Furnish with full faced flanges with matching welding type companion flanges. Connections to be bolted.

C. Flexible connectors by Metraflex of the same type may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 All specialties to be installed in accordance with manufacturer's recommendations.

3.02 Flexible vibration joints to be installed within tolerances specified by manufacturer.

END OF SECTION

SECTION 23 05 20

PAINTING

PART 1 GENERAL

1.01 REFERENCE

A. Division 9 - FINISHES

1.02 SCOPE

A. All steel supports shall have minimum one (1) coat of metal primer after fabrication.

B. Factory finished equipment which has rusted or been damaged shall be cleaned at the completion of the project and rust spots and marred areas shall be refinished and restored to the original factory finish.

C. All paints and finishes shall be Low VOC type, in accordance with Division 9 requirements and standards listed in LEED.

PART 2 PRODUCTS

2.01 PAINT SHALL MEET REQUIREMENTS OF DIVISION 9 – FINISHES, LISTED IN THE CITY OF DUBLIN STANDARDS. SUBMIT PROPOSED PAINT MATERIALS FOR APPROVAL TO THE A/E.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 23 05 21

CUTTING AND PATCHING

PART 1 GENERAL

1.01 REFERENCE

A. Division 01 - GENERAL REQUIREMENTS

B. Section 23 05 97 - REMODELING

C. Section 23 05 98 – DEMOLITION

D. See General Conditions, Article 2, Section 2.1 (with Supplementary Conditions) for additional cutting and patching requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 Avoid cutting of concrete, masonry and other new work by the use of inserts and sleeves.

3.02 ***Cutting for openings in existing walls or floors, when necessary for HVAC work, shall be the responsibility of the HVAC Contractor and shall be performed by a craftsperson skilled in such work. Cutting shall be performed with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.***

3.03 All holes in existing walls and floors shall be cut by use of core drills, using water to keep down the dust, and a method for catching water shall be provided. In addition, a vacuum cleaner shall be used with inlet as close to the hole being drilled as possible to pick up all dust caused by drilling.

3.04 The corners of all openings in poured concrete shall be core drilled to minimize overcutting.

3.05 This Contractor shall give the General Contractor locations and sizes of all openings required in new construction for the installation of mechanical equipment (other than piping openings), before walls, etc., are started. If it becomes necessary to cut into new work because of the failure of this Contractor to notify the General Contractor, then the General Contractor shall perform any necessary cutting and patching at this Contractor's expense.

3.06 Fill space in all areas where core drilled with packing where required to maintain the fire rating. Openings shall be temporarily fire-stopped until permanent fire stopping is installed. This includes holes left due to removal of piping or ductwork.

3.07 All holes cut for the installation of piping, ductwork and equipment shall be neatly patched and refinished with the same materials as, and to match, adjacent surfaces, and damages thereto shall be repaired in kind and to match existing conditions by the General Contractor at this contractor's expense. This includes patching existing ceilings and floors where required and patching holes left by removal of existing piping, ductwork, equipment, etc.

3.08 Patching shall match existing surfaces in kind and finish, and shall be done by the General Contractor at this Contractor's expense.

3.09 The Protection of Persons and Property Section of the General Conditions must be followed without exception. This includes precautions against Fire Hazards.

3.10 No structural member shall be cut into without the expressed permission of the Structural Engineer.

3.11 Coordinate work with hazardous materials abatement contractor.

END OF SECTION

SECTION 23 05 22
FOUNDATIONS AND SUPPORTS

PART 1 GENERAL

1.01 REFERENCE

Not Applicable

1.02 SCOPE

A. This Contractor shall furnish welded steel frames and supports for all equipment requiring same. Furnish auxiliary steel as required for supporting pipes.

PART 2 PRODUCTS

2.01 All steel for frames and supports shall be standard weight black or galvanized steel pipe or standard structural steel shapes.

2.02 All exterior frames and supports shall be galvanized.

PART 3 EXECUTION

3.01 Grind all sharp corners and projections on supporting steel after fabrication. All steel shall have one (1) coat of metal primer after fabrication. All steel supports exposed to the weather shall be hot dip galvanized.

3.02 Provide concrete housekeeping pads for all new floor-mounted equipment, including heat exchangers. Concrete pads shall extend a minimum of 4 inches on all sides of the equipment, and shall have chamfered edges.

END OF SECTION

SECTION 23 05 23
VALVES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary valves for piping systems and equipment in the building required to provide proper shut off and balancing of all systems included under this contract.

PART 2 PRODUCTS

2.01 Check valves shall be Crane, Fairbanks, Watts, Jenkins, Nibco, Milwaukee, Powell and shall <u>all</u> be by the same manufacturer.

2.02 Ball valves shall be as manufactured by Grinnell, Apollo, Watts or any of the manufacturer's listed herein for check valves. All ball valves to be by the same manufacturer.

2.03 Butterfly valves shall be as manufactured by Keystone, Center Line, Worcester, Watts, Grinnell, Jamesbury, Victaulic, Anvil, Tyco or any of the manufacturer's listed herein for check and ball valves. All butterfly valves to be by the same manufacturer.

2.04 Valves in Water Lines inside the building, including piping directly connected to the Utility distribution piping:

A. Butterfly Valves

1. 2-1/2" and larger size shall be cast or ductile iron valve. Furnish with grooved or lug pattern body, aluminum bronze disc, stainless steel stem, EPDM seat, extended neck for full 2" insulation, and positive shut off at 175 psig W.O.G. (2 ½"-12") and 150 psi W.O.G. (14"-20"). Equal to Keystone Fig. AR-2. Butterfly valves are not permitted for size 2" and smaller.

2. 5" and smaller shall have minimum 10 position lever actuators, with positive latching and position indicator. Valves 6" and larger shall have worm gear actuator.

B. Valves used for blancing of branch mains or individual pieces of equipment and/or individual coils shall be per See paragraph F, below; butterfly valves shall not be used for balancing.

C. Ball Valves

1. 2" size and smaller may be two-piece bronze body full port ball valve, screwed piping connections, union connection body, teflon seats, full port, blowout proof stem, adjustable packing gland, chrome plated bronze ball, and lever handle labeled for service controlled. Rated for 150 S.W.P. and 400 WOG. Equal to Apollo 70-300 Series.

D. Drain valves shall be ball valves as specified above with hose end connection and cap.

E. Check Valves

1. 3" and larger - iron body, bronze mounted, horizontal swing check with bronze disc, flanged, 125 lb. S.W.P.

2. 2-1/2" and smaller - all bronze, horizontal swing check with bronze or TFE disc, screwed, 125 lb. S.W.P.

3. Non-slam check valves at pumps only - 2-1/2" and larger shall be grooved or flanged, cast iron or semi-steel body, bronze trim, center guided lift check with bronze disc and stainless steel spring, 125 lb. S.W.P. 2" and smaller shall be screwed, bronze, cast iron or semi-steel body, bronze trim, center guided lift check with bronze or TFE disc and stainless steel or alloy spring, 125 lb. S.W.P.

4. Clow, McAlear, Mueller, Victaulic, Anvil, Tyco or Metraflex non-slam check valves are acceptable manufacturers as well as previously listed manufacturers.

F. Combination Balance and Stop Valve - Bell and Gossett "Circuit Setter Plus", bronze body, screwed combination balance and stop ball valve. Valves to have readout ports, 1/4" drain port, memory stop indicator, calibrated nameplate, 300 lb. W.O.G. Same type stop and balance valves by Hayes, Flow Design, Tour & Anderson or Taco may be furnished at the Contractor's option.

G. Triple Duty Valve – Bell and Gossett - straight pattern valve designed to perform the functions of a non-slam check valve, throttling valve, shutoff valve, and calibrated balancing valve.

1. The valve shall be of heavy-duty cast iron construction with 125 psi ANSI flanged connections suitable for 175 psi working pressure for operating temperatures up to 250°F. The valve shall be fitted with a bronze seat, replaceable bronze disc with EPDM seat insert, stainless steel stem, and chatter preventing stainless steel spring. The valve design shall permit repacking under full system pressure.

2. Each valve shall be equipped with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance.

3. Watts, Wheatley or Armstrong triple duty valves may be furnished at the Contractor's option.

G. All valves shall be produced domestically.

PART 3 EXECUTION

3.01 This Contractor shall install all valves in strict accordance to the manufacturer's recommendations.

3.02 Where drain lines are not piped to floor drains, furnish hose end adapters. Provide caps for all hose end adapters.

3.03 Ball valves used for balancing and designated with an “M” shall be furnished with memory stops.

3.04 This Contractor shall remove the start-up strainer from all strainers after systems are operational and system has been chemically treated; this includes basket strainers on open loop, untreated well water piping systems.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:
1. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

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

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Flex-Strut Inc.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut Corporation; Tyco International, Ltd.
   g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Provide prime coat of paint.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. NIBCO INC.
   c. PHD Manufacturing, Inc.
   d. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Clement Support Services.
2. National Pipe Hanger Corporation.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

C. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

D. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Provide test report for concrete placed in equipment bases.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and larger: 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

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

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

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

3.4 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports or metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 no insulation is required.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
6. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
8. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
9. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
10. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
11. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
12. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
14. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

K. Hanger-Rod Attachments: Provide appropriate attachments.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 30
INSTALLATION OF PIPING

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 19 - PIPING SPECIALTIES
B. Section 23 05 23 - VALVES
C. Section 23 05 29 - INSERTS, PIPE HANGERS AND SUPPORTS
D. Section 23 05 93 - TESTS AND ADJUSTMENTS

1.02 SCOPE

A. The requirements of this Section shall apply to all interior piping systems installed under this Contract, except where otherwise noted on the Drawings or elsewhere in the Specifications.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 All piping systems shall be installed with adequate provisions made for expansion and contraction to prevent stresses on piping, valves and equipment. Anchor and guide piping at all points indicated and/or as required.

3.02 Provide unions or flanges at each final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane, and one change of direction in the vertical plane, before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of parts and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Unions to be downstream of valves.

3.03 Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.

3.04 All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.

3.05 Provide valves and specialties where indicated on the drawings.

3.06 Ream ends of pipe and clean before installing.

3.07 All joints in copper piping shall be made with 95-5 solder. Solders and fluxes containing lead are prohibited.

3.08 Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.

3.09 Make all changes of direction with fittings, rather than bending.

3.10 All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

3.11 Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel.

3.12 Bull head connections in any piping service are expressly prohibited.

3.13 At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes, whether it be inadvertent or with malicious intent.

3.14 Install Pete's Plugs as close as possible to control valves, coils, etc., as shown on the Drawings, and arranged so that a probe may be inserted into the plug.

3.15 Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.

3.16 Install galvanized sheet metal troughs with drains under pipes crossing above electrical equipment. Seal to make water tight.

3.17 Do not run piping through electrical rooms or data rooms.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Restrained vibration isolation roof-curb rails.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 120 MPH.
2. Building Classification Category: II
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by a registered design professional licensed in the state of Ohio.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For vibration isolation details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, and wind forces required to select vibration isolators, and wind restraints, and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Wind-Restraint Details:

    a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kinetics Noise Control or a comparable product by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Mason Industries.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

F. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

I. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kinetics Noise Control or a comparable product by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Isolation Technology, Inc.
4. Mason Industries.
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation.
7. Vibration Mountings & Controls, Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Equipment Restraints:

1. Install snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install restraint devices using methods approved an evaluation service member of ICC-ES providing required submittals for component.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

C. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train the City of Dublin's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration and Training."

3.6 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment: In-Line Pumps.

1. Equipment Location: Indoor Mechanical Rooms.
2. Pads: None
3. Isolator Type: Isolation Hanger, Kinetics Model SRH.
4. Base Type: None.
5. Minimum Deflection: 0.75 inches.

B. Supported or Suspended Equipment: Base Mounted Pumps (Chilled and Heating Hot Water).

1. Equipment Location: Mechanical Room.
2. Pads:
   a. Material: Neoprene
   b. Thickness: ½ inch thickness, Kinetics Model NGS.

3. Isolator Type: Spring Floor, Kinetics Model FDS.
4. Base Type: Concrete Inertia Base, Kinetics Model CIB.
5. Minimum Deflection: 1.5 inches.

C. Supported or Suspended Equipment: Unit Heaters.

1. Equipment Location: Various.
2. Pads: None.
3. Isolator Type: Isolation Hanger, Kinetics Model SH.
4. Base Type: None.
5. Minimum Deflection: ½ inch.

D. Condenser water piping within 10 Lf of Condenser water pumps
1. Equipment Location: Mechanical Rooms
2. Pads: None.
3. Isolator Type: Isolation Hanger, Kinetics Model SRH.
4. Base Type: None.
5. Minimum Deflection: ½ inch.

END OF SECTION

SECTION 23 05 53
TAGGING AND CODING

PART 1 GENERAL

1.01 SCOPE

A. Provide brass tags on all valves. Tags shall state type of line in which the valve is installed (heating water supply, etc.), floor and number of valve (example: HWS-02-253). Match existing City of Dublin Design Standards for identification and valve tagging that is in place at the building.

B. After piping and insulation is complete (and painted where required by section 23 05 20), this Contractor shall apply 2" wide color bands on each side of a stenciled legend, lettered with the name of contents of piping. Piping above ceilings shall also be labeled Flow direction arrows of the same colors are to be located adjacent to the Identification Legends. Spacing not over 20 ft. apart and at least once in each room. Do not use adhesive markers. Color as approved by the City of Dublin.

C. Vavle Chart: For each system type, provide a framed directory under glass in the mechanical equipment room. Provide a copy of the valve directory in the O&M Manuals.

PART 2 PRODUCTS

2.01 Valve tags shall be brass minimum 16 gauge.

PART 3 EXECUTION

3.01 Abbreviation for Process and Non-Process Valves:

a. HWS – Heating Hot Water Supply
b. HWR – Heating Hot Water Return
c. CHS – Chilled Water Supply
d. CHR – Chilled Water Return
e. CWS – Condenser Water Supply
f. CWR – Condenser Water Return
g. GWS – Geothermal Water Supply
h. GWR – Geothermal Water Return
i. V – Vent
j. D – Drain
k. DW – Domestic Water
l. CA – Compressed Air
m. IA – Instrument Air
n. Other items – per City of Dublin standards, obtain approval (Match Existing Piping)

END OF SECTION

SECTION 23 05 54

EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

A. This Contractor shall label all disconnects, motor starters, switches and equipment furnished under this Contract.

B. Provide equipment identification following City of Dublin standard nomenclature.

PART 2 PRODUCTS

2.01 Labels shall be brass, with manufacturer's operational data plus information regarding areas or other equipment served stamped onto the label. Submit proposed text to the A/E for approval.

2.02 VAV BOXES

A. Provide brass, aluminum, or plastic labels for each VAV box; include Equipment Tag, CFM range, and Heating Coil flow/MBH.

PART 3 EXECUTION

3.01 Secure plates with screws or pop rivets. Do not attach to covers where covers can be easily mixed up. Coordinate with the Temperature Control Subcontractor so that all nameplates are the same type and design.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 Air and water balancing of the new systems shall be performed as a part of the HVAC Contract, and will be bid as part of the overall construction contract, in the HVAC section of the contract. The information in this specification section is for reference and coordination of responsibilities between the HVAC/Building Automation System contractor and the TAB contractor.

Balancing work will be performed by qualified personnel of a member firm of the Associated Air Balance Council (AABC) or a member firm of the National Environmental Balancing Bureau (NEBB), who has no affiliation with the HVAC Contractor, the Sheet Metal Contractor or any of their subcontractors.

The HVAC contractor shall be responsible for the coordination of their equipment with the requirements of the TAB contractor. These coordination costs shall be included in the HVAC contract. The following items are specific to the coordination of the TAB and HVAC.

- The Building Automation System contractor shall provide the TAB contractor with any necessary testing equipment and/or software required to complete the TAB work on the equipment where the Automatic Temperature Controls are integral to the TAB work.

- The HVAC contractor shall provide all necessary sheave and belt changes as well as any pump adjustments (both material and labor) as required by the TAB Contractor to obtain air and water quantities as shown or required.

- The HVAC contractor shall keep at the jobsite and make available to the TAB contractor suitable lifts that are required to balance the equipment in high-bay areas. The TAB and HVAC contractor shall coordinate this requirement and develop a plan that is submitted to the A/E as part of the construction schedule at least 30 days before the TAB contractor requires their use.

- Balance reports shall include starter element sizes, voltage and amperage ratings for each motor. If starter elements amperage rating is more than 10 percent greater or less than motor nameplate amperage, the TAB contractor shall inform the responsible contractor who will then furnish and install proper size elements. Balance report shall include the corrected proper size starter element sizes and amperage ratings.

1.2 Methods, procedures, equipment, certifications, report forms and reporting information will be in accordance with the standards of AABC or NEBB and latest addition of the SMACNA TAB Procedural Guide and industry practice.

1.3 Prior to installation of the systems, the TAB Contractor will verify that the proper number and location of balancing devices are adequate for completion of the balancing work. The HVAC Contractor shall provide and install additional devices as required by the TAB contractor.

1.4 The TAB contractor will call for a meeting with owners and Engineer's representatives on approval of TAB strategies and procedures plan in order to develop a mutual understanding of the details. This meeting will ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days advance notice of scheduled meeting time and location and coordinate with the A/E.

1.5 The TAB contractor will prepare a TAB plan that includes strategies and step-by-step procedures. This plan should include a list of items that must be completed before TAB can proceed. The TAB contractor will prepare a schedule to ensure adequate time for the TAB process and submit this schedule to the responsible party to be part of the Project Construction Schedule.

1.6 When project is in phases and partial occupancy is planned, the TAB contractor will determine a process to allow TAB work to be completed before occupancy.

1.7 The HVAC contractor shall refer to the appropriate Section of the specifications for requirements of the HVAC Equipment Drives and requirements related to the balancing work.

1.8 The TAB contractor will verify that all equipment start-up services have been completed before the beginning of any TAB work. After initial start-up has been completed the HVAC contractor shall informed the TAB contractor that the systems are operating properly, that all safety interlocks and protective devices are functioning, and the systems are ready to be balanced.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 The TAB Contractor shall complete the Balance work per their contract requirements. The following is a list of items that will be completed by the TAB contractor.

A. Record nameplate data from fan, motor, and air handling cabinet.

B. Record and measure fan and motor sheaves indicating number and size of belts along with center-to-center distances.

C. Test and record actual operating fan rpm.

D. Measure and record actual running amperage.

E. Each air supply, return, and exhaust system, when installation is completed, including the installation of clean filters, shall be set in operation by the HVAC contractor for balancing. Determine the best location in main and branch ducts for accurate duct airflow measurements. Each air outlet and inlet device, item of equipment (fans, air control units, etc.), and system shall be balanced to the quantities listed on the drawings within plus or minus 10%. Intended pressure relationships in areas required by recognized standards and practice shall be attained.

F. The TAB contractor may require the HVAC contractor to adjust drive pulleys to attain fan speed required for the installed condition. Upon final determination of proper operating speed pulleys (as allowed by the project specifications) shall be installed by the HVAC contractor. Pulleys and belts of fixed drives and of adjustable drives not having sufficient adjustment range shall be changed out by the HVAC Contractor, at the direction of the TAB contractor, to obtain fan speed required for the installed condition. Labor /or materials required to make the recommended changes shall be included in the HVAC Contract.

G. Measure velocity reading across coils, filters, and dampers on the intake side of the fan. Include data in the report.

H. The TAB will coordinate with the Temperature Control Contractor in setting supply and return fan inlet vanes / variable frequency drives / and / outside air, return air and vent air

dampers. Supply air systems will have ampere reading measured in the full heating, full cooling and economizer modes to determine the maximum brake horsepower.

I. Total air quantities of the supply fan, the return fan, and exhaust fan shall be determined by pitot tube traverse. Where impossible to take good pilot tube traverses of duct system, use total sum of terminal device air volume readings. Final settings of fan speeds shall be determined with automatic volume control devices at the fans fully open / variable speed drives at full speed. Refer to item F. above for drive change-out requirements and the items below.

J. Check for airflow blockages.

K. Check for proper sealing of air-handling unit components. Report all issues on TAB report.

L. Check for proper sealing of air duct systems. Minor issues shall be reported on the TAB report. If a major issue is found, stop TAB work and report issue to Construction Management Authority and HVAC Contractor for resolution before continuing with the project.

M. The report shall include, but not be limited to, both actual and design fan cfm, rpm, brake HP, entering and leaving static pressures, motor data, voltage and amperage and drive information. System air flows by device, terminal, branch and system shall be reported.

N. Mark equipment and balancing device setting with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-controls levers, and similar controls and devices, to show final setting.

O. Pressurization measurements should not start till TAB has observed the space to verify the integrity of the space boundaries. If the building is being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

3.2 Water Balance

A. The HVAC contractor shall set each water-circulating system, when installation is completed, in operation for balancing. Water flow thru each pump, chiller, coil, heat exchange device, balancing valve and water flow meter shall be determined by pressure differential gauging or direct reading. The TAB contractor will prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Flows will be balanced to quantities listed on the drawings within plus or minus 5%.

B. The TAB contractor will check and compare expansion tank set-up data to design requirements for proper operation. Report any deviations to HVAC Contractor and Construction Management Authority for corrective action.

C. The TAB contractor will check makeup-water-station pressure settings for adequate pressure.

D. The TAB contractor will check flow-control valves and set to indicated flow.

E. The HVAC contractor shall verify that air has been vented from system. The TAB contractor will check air vents for a forceful liquid flow exiting from vents when manually operated.

F. The TAB contractor will verify pump data, including pump-motor brake horsepower and impeller size on nameplate data to design submittals.

G. Pump tests shall show full flow and dead head conditions. Pump flow control valves shall not be closed more than fifty percent. Pump flow control valves, which require more than fifty percent closure shall be reported to the contractor and engineer for evaluation of valve sizing and selection. Automatic valves shall be fully open during testing of the unit associated with the control valve.

H. The TAB contractor will measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads and system pressures and temperatures including outdoor air temperature.

I. The TAB contractor will measure the differential-pressure control valve settings existing at the conclusions of balancing.

J. Water Coils and heat exchangers: The TAB contractor will record water flow rate and water pressure drop.

K. The report shall include, but not be limited to, both actual and design water quantities, pressures in and out of each device, pump motor data, operating voltage and amperage and pump curves.

L. The TAB contractor will mark equipment and balancing device setting with paint or other suitable, permanent identification material, including valve-control positions, valve position indicators and similar controls and devices, to show final setting.

3.3 After completion of the balancing work, a preliminary full report shall be prepared in pencil and two copies (only) submitted to the Engineer for preliminary review. After review, additional balancing, adjustments, drive replacements, readings and recordings deemed necessary shall be done and the report revised. Six typed copies of the final report shall be submitted thru the HVAC Contractor to the Engineer for review and approval. An approved copy of the report shall be included in each set of operating and maintenance manuals.

3.4 Final Report contents: In addition to certified field report data, include the following:

A. Table of Contents with total number of pages defined for each section of the report.

B. Summary of Contents - include the following:

1) Indicated versus final performance.

2) Notable characteristics of systems.

3) Description of system operation sequence if it varies from the Contract documents.

C. Nomenclature sheets for each item of equipment

D. Notes to explain why certain final data in the body of reports varies from indicated values

E. System component diagrams including schematic layouts of air and hydronic equipment. Present each in single-line format with data points indicated

3.5 TAB verification: Commissioning Authority/Construction Management Authority shall randomly select measurements documents in the final report to be rechecked. The rechecking shall be limited to 5% of the total measurements recorded.

3.6 Seasonal Testing: If initial balancing procedures were not performed during near peak summer and winter conditions, perform additional testing, inspecting and adjusting during near peak summer or winter conditions.

3.7 10 Month Warranty Walk: Perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to report unusual conditions with recommendation of adjustments. Allow one day for this work

END OF SECTION

SECTION 23 05 93

TESTS AND ADJUSTMENTS

PART 1 GENERAL

1.01 SCOPE

A. After work has been completed but before pipe covering has been applied, the Contractor shall test and adjust the systems he has installed.

B. The A/E shall be notified of all scheduled tests and adjustments at least 48 hours before they are scheduled so that he may witness same. If the Contractor performs any test or adjustment without the A/E present or without properly notifying the A/E, the Contractor will be required to perform the test or adjustment a second time in the presence of the A/E.

C. If the A/E determines that any work requires special inspection, testing, or approval, he will, upon written authorization from the City of Dublin, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the A/E may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the A/E additional services made necessary by such failure; otherwise the University shall bear such costs, and an appropriate Change Order shall be issued.

D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, this Contractor shall repair leak and all damage resulting therefrom.

E. This Contractor shall adjust all equipment in the HVAC system to obtain proper operation and shall demonstrate to the City of Dublin and A/E that the entire system will function properly.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TESTING OF WATER SYSTEMS

A. Pressure test Geothermal Water piping, Condenser Water and Chilled Water piping systems with water, not less than 125 psig, for not less than 6 hours with no pressure drop.

3.02 BALANCING AIR AND WATER SYSTEMS:

A. The HVAC Contractor shall procure the services of an approved balancing contractor to provide all balancing services for this project. The balancing contractor shall be an independent company that specializes in the testing and balancing of air and water systems. All balancing work shall be done under the direct supervision of a qualified balancing contractor technician. The Balancing Company shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB), and may include the following qualified firms:

1. Kahoe Air Balance Company
2. Environmental Balancing Co.

B. Pre-Balance Meeting: The A/E, the City of Dublin, the balancing contractor, the HVAC Contractor, and the Controls Sub-Contractor shall attend a pre-balance meeting. At the pre-balance meeting, the Balancing Contractor shall review balancing methods and procedures, including: testing and setting dampers, testing total heating CFM, testing total cooling CFM, and hydronic system balancing.

C. A detailed report of all balancing work shall be prepared and submitted, in triplicate, to the A/E for review. Each copy of the report shall be dated and signed by the supervising balancing contractor's representative and bound in a suitable cover.

D. Balancing procedures and report to be in accordance with procedures set forth by the Associated Air Balance Council. Report shall also include fan and pump curves for all equipment.

E. Where Pete's Plugs are installed, report shall include pressure drop readings across coils, control valves (Cv), etc., to confirm flow rates. Where flow meters are provided, they shall be used to confirm flow rates.

F. Balance reports shall include starter element sizes, and amperage ratings for each motor. If starter elements amperage rating is more than 10 percent greater or less than motor nameplate amperage, this Contractor shall inform the Electrical Contractor to furnish and install proper size elements. Balance report shall include the corrected proper size starter element sizes and amperage ratings.

G. Prior to any hydronic balancing, the new portions of the hydronic systems shall be circulated and determined to be internally clean and leak-free. The hydronic system contractor shall open and remove all start-up strainers and replace with the permanent strainer. All air shall be removed from the hydronic system prior to the balancing.

H. For three-way hydronic control valves, the balance contractor shall balance for identical system flows at full flow through the coil, and full flow through the bypass.

I. Test and adjust water flow to coils to obtain the specified flow. Compare actual water side pressure drops with manufacturer's published data. Where equipment is used in heat transfer, measure entering and leaving liquid conditions and compare to manufacturer's published data. Include results along with manufacturer's published data in the balance report.

J. Where possible, simulate design conditions for testing. If simulation is not practical, perform seasonal testing during the project when design conditions can be achieved. Air systems shall be balanced at full heating airflows and full cooling airflows.

K. Balance Subcontractor shall report by letter to the A/E the preliminary results of balancing before the final balance report is prepared. This report shall include any problems encountered during balancing or major deviations from specified conditions.

L. If required, a meeting shall be arranged between this Contractor, the Balance Subcontractor, the Commissioning Agent, and the A/E to resolve any problems or deviations from the Contract Drawings and Specifications before the final balance work is completed and final report is submitted for review by the A/E.

3.03 All dampers, damper operators and motor operated valves shall be checked and adjusted for proper operation and travel.

3.04 This Contractor shall adjust all equipment in the mechanical system to obtain proper operation and shall demonstrate to the City of Dublin and A/E that the entire system will function properly.

A. Contractor shall include two site visits to assist the controls contractor in the calibration of the water flows at all chillers and other items.

END OF SECTION

SECTION 23 05 94

PROTECTION AND CLEANING

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 20 - PAINTING

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 See the General Conditions for Construction Facilities, Utilities, and Equipment requirements.

3.02 Protect all mechanical equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.

3.03 After all equipment and ductwork has been approved and after all plastering has been completed, ductwork and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil, and primed (where necessary), ready for painting.

3.04 Repair all dents and scratches in factory prime or finish coats on all mechanical equipment, to the satisfaction of the A/E. If damage is excessive, replacement may be required.

3.05 If heating units are operated for temporary heat during construction, this Contractor shall replace all throwaway and prefilter type filters before the building is turned over to the City of Dublin.

3.06 Cover all motors, fans, pumps, open pipes, etc., to keep out dirt, water and weather during construction.

3.07 This Contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

3.08 This Contractor shall provide filter material over the existing return air grilles during construction. Return air grille filter media shall be changed at least every two weeks or more frequently if needed during the duration of this construction project.

3.09 Chilled Water System, Condenser Water System, and Geotheramal Water System Flush/Fill:

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial closed loop chemical treatment and maintain water quality for the first year of operation for condenser piping systems that are contained within the building.

C. Open Loop Geotheral system shall be flushed prior to connection to the plate and frame heat exchanger at 100% of design flow. See site specifications.

END OF SECTION

SECTION 23 05 97
REMODELING

PART 1 GENERAL

1.01 REFERENCE

A. Division 01 - GENERAL REQUIREMENTS
B. Section 23 05 21 - CUTTING & PATCHING
C. Section 23 05 98 - DEMOLITION

1.02 SCOPE

A. Limited renovation work is being performed within the existing building. This Contractor shall include the remodeling of and additions to all mechanical work in the areas indicated on the Architectural and HVAC drawings. All necessary or required remodeling or additions to the present mechanical work shall be included in this Contract, as indicated or required, to the end that the work will result in the finished remodeled spaces shown on the Architectural Drawings.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 In all of the remodeling work the HVAC work shall follow the intent of the HVAC specifications insofar as possible with regard to material and workmanship.

3.02 Where old walls and furrings are removed, exposed piping that will remain in use shall be offset to the nearest available new wall or concealed space and reconnected as necessary or required, using all new material. Note that this shall include piping of every description at both known and unknown locations.

3.03 All piping installed in the remodeling work shall be installed as concealed work, unless noted otherwise. **This Contractor shall perform all cutting and patching required.**

END OF SECTION

SECTION 23 05 98
DEMOLITION

PART 1 GENERAL

1.01 REFERENCE

A. Division 01 - GENERAL REQUIREMENTS
B. Section 23 05 21 - CUTTING & PATCHING
C. Section 23 05 97 – REMODELING

1.02 SCOPE

A. The HVAC Contractor shall be responsible for all HVAC demolition in all areas that will be renovated as part of this project. Refer to the demolition drawings and demolition notes. The HVAC contractor shall be responsible for equipment disconnects and coordination with the general contractor to identify the equipment, piping, etc. that is to be removed.

B. The HVAC Contractor shall be responsible for removal and reinstallation of the existing ceiling systems, if any, as required to facilitate the above ceiling HVAC work indicated on the drawings.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 23 07 16
HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. HVAC pumps.
2. Air separators.
3. Plate-and-Frame Heat Exchangers.
4. All other HVAC equipment connected to Chilled Water systems.

B. Related Sections:
1. Division 23 Section "HVAC Piping Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail removable insulation at equipment connections.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.
5. Detail field application for each equipment type.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
2. Sheet Form Insulation Materials: 12 inches (300 mm) square.
3. Sheet Jacket Materials: 12 inches (300 mm) square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 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.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

C. Coordinate installation and testing of heat tracing.

1.8 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.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following.

   a. CertainTeed Corp.; CertaPro Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H.B. Fuller Company; CP-76.
   b. Eagle Bridges – Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H.B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.5 FIELD-APPLIED JACKETS

A. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper
   d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following.

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following.

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] wide with wing seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, ½ inch (13 mm) wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated.

2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

3. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel or aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

2.8 CORNER ANGLES

A. Aluminum Corner Angles: [0.040 inch (1.0 mm)] thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

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

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

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

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

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

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

F. Keep insulation materials dry during application and finishing.

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

H. Install insulation with least number of joints practical.

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

J. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. 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.

3.4 INSTALLATION OF EQUIPMENT, HEAT EXCHANGER, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle

around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.

7. Stagger joints between insulation layers at least 3 inches (75 mm).
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.6 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses shall match thicknesses of heating or chilled water piping connecting to the equipment. Insulate indoor and outdoor equipment that is not factory insulated.

3.7 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed: None.

D. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter:

1. Aluminum, Corrugated, 0.020 inch (0.51 mm) thick

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condener water piping, indoors.

2. Chilled-water piping, indoors.

3. Heating hot-water piping, indoors.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.

4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties.

6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN 50).

2. Sheet Form Insulation Materials: 12 inches (300 mm) square.

3. Jacket Materials for Pipe: 12 inches (300 mm) long by NPS 2 (DN 50).

4. Sheet Jacket Materials: 12 inches (300 mm) square.

5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 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.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing, if any.

1.8 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.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Industrial Insulation Group (IIG); Thermo-12 Gold.

2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I or II with factory-applied vinyl jacket Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.

b. Johns Manville; Microlite.

c. Knauf Insulation; Friendly Feel Duct Wrap.

d. Manson Insulation Inc.; Alley Wrap.

e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.

b. Johns Manville; Micro-Lok.

c. Knauf Insulation; 1000-Degree Pipe Insulation.

d. Manson Insulation Inc.; Alley-K.

e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Knauf Insulation; Permawick Pipe Insulation.

b. Owens Corning; VaporWick Pipe Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.

2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).

3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

3. Solids Content: 60 percent by volume and 66 percent by weight.

4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).

4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.

3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).

4. Color: White or gray.

5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).

4. Color: Aluminum.

5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).

4. Color: White.

5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.

c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.

b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.

2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.

4) Flange and union covers.

5) End caps.

6) Beveled collars.

7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches (75 mm).

2. Thickness: 11.5 mils (0.29 mm).

3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

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

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

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

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

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

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

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

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

G. Keep insulation materials dry during application and finishing.

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

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

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

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Molded plastic fitting covers shall be U.L. approved with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

2. Pipe insulation shall be Johns Manville "Micro-Lok" glass fiber insulation rated for 850°F. with factory applied AP-1 all purpose, self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide of same material as jacket.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.

2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.

3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.

3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

2. Install insulation to flanges as specified for flange insulation application.

3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.

2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.

3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.9 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping (Chilled water is provided with factory insulation).
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate, Condenser Water, and Geothermal Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick for exterior piping.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

B. Chilled Water and Brine, above 40 Deg F (5 Deg C):

1. 8” and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. Provide aluminum jacket.

C. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and Below:

1. 4” and Smaller: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) thick.

2. Over 4”. Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe, Type I, 1-1/2 inches (38 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None. Factory jackets acceptable.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Painted Aluminum, stucco embossed with Z-Shaped Locking Seam: 0.016 inch (0.41 mm) thick.

E. Provide heat trace for condensate and geothermal installed outside above grade.

END OF SECTION

SECTION 23 21 13.13
CONDENSER WATER PIPING

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 30 - INSTALLATION OF PIPING
B. Section 23 07 00 - HVAC INSULATION

1.02 SCOPE

A. From existing chiller to new plate-and-frame heat exchanger, provide a complete system of condenser water piping.
B. Pipe and Fittings on the geothermal water side of the plate-and-fram heat exchanger shall comply with this secton as well for above-ground piping. Refer to Division 33 for underground and dircect-bury piping associated with the geothermal well water piping.

PART 2 PRODUCTS

2.01 Pipe - Schedule 40, seamless black steel, ASTM Specification A53 or A106, Grade B, rated for a design pressure of 100 PSIG (tested at 150 PSIG).

2.02 Fittings for piping 2-1/2" and smaller - 125 lb. black cast iron except the Contractor may, at his option, use weld joints in piping 1-1/2" and larger. Use standard weight welding fittings.

2.03 Fittings for piping 3" and larger - standard weight welded fittings.

2.05 At the Contractor's option, weldolets, butt or threaded type, may be used for branch connections that are less than 2/3 main size. Use welded or screwed fittings for branch connections 2/3 main size or larger. Shaped nipples are not acceptable.

2.06 Flexible couplings (Victaulic or similar) are permitted where piping is not concealed behind permanent construction.

PART 3 EXECUTION

3.01 Install water mains without pitch. Use eccentric reducing couplings at changes in size, with top of pipes at same elevation. Use concentric reducers in vertical mains.

3.02 Install manual air vents at high points of the system for proper air venting of system.

END OF SECTION

SECTION 23 21 13.33
CONDENSATION DRAIN AND DRAIN PIPING SYSTEMS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 30 - INSTALLATION OF PIPING
B. Section 23 07 00 - HVAC INSULATION

1.02 SCOPE

A. Provide condensation drain piping from drain connections of all air conditioning equipment and run indirect to floor drains and elsewhere as shown on the Drawings.

B. Provide drain piping from drain valves and overflows to floor drains and elsewhere as indicated on the drawings.

C. Provide drain piping from all pump casing drains and run indirect to floor drains and elsewhere as shown on the drawings.

PART 2 PRODUCTS

2.01 PIPE

A. Type DWV hard drawn copper drainage tubing for drains. PVC piping **shall not** be used.

2.02 Fittings shall be cast brass drainage fittings.

PART 3 EXECUTION

3.01 All condensation drain lines shall be trapped. Traps shall be piped as detailed on the drawings.

3.02 Pitch all condensation and other drain lines down a minimum of 1" per 8’ in the direction of flow.

3.03 Prior to leaving the jobsite, the HVAC Contractor shall flood the cooling coil drain pans with the units operating to verify that the drain pans are draining properly.

END OF SECTION

SECTION 23 21 13.43
WATER MAKE-UP PIPING SYSTEM

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 30 - INSTALLATION OF PIPING
B. Section 23 07 00 - HVAC INSULATION

1.02 SCOPE

A. Connect to existing domestic water backflow preventer outlet and extend make-up piping to the concenser water make-up connections and other locations shown on the drawings.

PART 2 PRODUCTS

2.01 Pipe - Type L hard drawn copper tubing.

2.02 Fittings - Wrought copper solder type.

2.03 Water make-up valve - Bell and Gossett model B7-12, iron body, automatic reducing valve, ¾" size, factory set at 12 psi. Install valve in make-up water line. Thrush or Watts of the same type may be furnished at the Contractor's option.

2.04 Provide solenoid shut-off valve on make-up water line, with DDC connection.

2.05 Provide pulse type water meter on make-up water line, for DDC Control.

PART 3 EXECUTION

3.01 Install valves, thermometers, pressure gauges, etc., where shown on Drawings.

3.02 Run all water make-up piping level.

END OF SECTION

SECTION 23 25 13
HVAC WATER TREATMENT SYSTEM

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 30 - INSTALLATION OF PIPING
B. Section 23 05 94- PROTECTION AND CLEANING

1.02 WORK INCLUDED

A. Provide a complete and working water treatment system as herein specified and indicated on the Drawings.

B. The water treatment supplier shall provide the following services:

1. All preoperational system cleanout chemicals.

2. Chemical shot feed equipment as described herein.

3. All necessary test equipment for control of chemicals and bleed off.

4. Instruct the Mechanical Contractor on precleaning procedures.

5. Instruct the Mechanical Contractor on the installation of the feed and bleed equipment.

6. Provide training for the operating personnel.

7. Provide one year field service and consultation which will include monthly service visits with written test results, recommended adjustments, and a written report to the City of Dublin.

8. Provide one year supply of chemical treatment.

9. Provide laboratory testing of samples as needed.

10. System start-up assistance.

C. Provide a chemical treatment system for the closed loop chilled water system and the closed loop heating hot water system as shown on the Drawings.

D. Contractor shall include the cost of chemicals as described below, and shall consider the entire volume of the building heating and cooling water systems.

PART 2 PRODUCTS

2.01 WATER TREATMENT

A. Preoperational System Cleanout Specifications

1. All new circulating water systems shall be thoroughly flushed out with Chardon Water Treatment's precleaning chemicals. These chemicals shall be circulated as directed by the Chardon Water Treatment service technician. The system shall then be flushed with fresh water, drained a second time and refilled. All strainers shall be cleaned after this cleanout procedure. After final filling, the pH of the

system water shall not exceed the pH of the fresh incoming water by more than .5 pH, and the system water shall have no remaining visible foreign matter.

A. Operational Closed Loop System Specifications

1. Following cleaning/flush-out of the closed loop systems, provide corrosion and scale inhibitors, defoamers, and microbiological control chemicals recommended by the chemical treatment supplier.
2. Provide anodic and cathodic corrosion inhibitors, scale inhibitor, buffering agents for pH control. Concentrations as recommended by the water treatment supplier.

2.02 FEED AND BLEED EQUIPMENT SPECIFICATIONS

A. Closed Loop Systems

1. Furnish and install one steel five gallon filter-shot feeder with stainless steel filter bag basket for the closed loop chilled water system and the open loop well water system. This shall have a pressure rating of 150 psig. The filter shot feeder shall be piped across the circulating pumps with ball valves on each side of the feeder. Furnish one year's supply of 5 micron filter bags.

2. Nitrite water treatment shall be liquid, with an active ingredient in the range of 10 to 35 percent maximum nitrite, by weight.
3. The treatment shall have no corroding or disintegrating effect on the gaskets or pump seals.
4. The product shall meet EPA and FDA acceptance.
5. The material shall be a free flowing liquid, 9.3 pounds per gallon, with no flash point.
6. Control levels shall be maintained between 1000 and 1200 ppm of nitrate.

7. Chromates and phosphates are not acceptable.

8. Provide nitrite test kit and PH test kit.

2.03 TEST EQUIPMENT

A. Furnish Chardon condenser water test kit with necessary apparatus and reagents for one year of testing. Test kit should include reagents to perform tests on the following:

1. Chlorides
2. Hardness
3. P and M alkalinity
4. Condenser system inhibitor chemical level
5. pH
6. Specific conductance (portable meter must be provided)
7. Chilled system inhibitor chemical level

2.04 Equal equipment, open and closed loop and pre-cleaning chemicals may be furnished by Chardon, Vulcan, Calgon, Betz, or Columbus Technical Services.

PART 3 EXECUTION

3.01 INSTALLATION

A. Furnish and install all mounts, piping, tubing and valves necessary to install the complete operable water treatment system as shown on the drawings and under the supervision of the chemical company.

B. The HVAC Contractor shall furnish sufficient chemicals to maintain the closed loop water systems free of corrosion, scale, and biological growth, after system start-up. System shall not be operated for temporary heating or cooling without chemical treatment.

3.02 In all locations where chemicals are dispensed, the Contractor shall obtain safety data sheets from Chardon and place in a "see-thru-folder" and post in visible work area. The Contractor shall provide all special safety equipment required for handling chemicals.

3.03 The operation of the chemical treatment system shall be completely tested after the installation is complete.

3.04 Open loop systems shall be flushed with wall water only at 100% of design flow; no chemicals are permitted for geothermal open loop piping.

3.06 FLUSHING, CLEANING, AND TESTING SEQUENCE

A. General – Submit proposed flushing and testing procedures to the A/E for approval.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

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

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

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Greenheck Fan Corporation.
2. Hartzell Fan Incorporated.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.

F. Capacities and Characteristics: Refer to drawings.

2.2 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using neoprene pads, unless noted otherwise.

C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 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. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

END OF SECTION

SECTION 235700 - HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plate-and-frame heat exchangers.

1.3 DEFINITIONS

A. TEMA: Tubular Exchanger Manufacturers Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: Details and design calculations for seismic restraints for heat exchangers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Maintenance space.
2. Structural members to which heat exchangers will be attached.

B. Product Certificates: For each type of heat exchanger.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design seismic restraints for heat exchangers.

2.2 GASKETED-PLATE HEAT EXCHANGERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide TACO or comparable product by one of the following:

1. Alfa Laval Inc.
2. API Heat Transfer Inc.
3. ITT Corporation; Bell & Gossett.
4. Mueller, Paul, Company.

B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. Frame:

1. Capacity to accommodate **20** percent additional plates.
2. Painted carbon steel with provisions for anchoring to support.

E. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.

1. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger carrying and guide bars are anchored to building structure.

F. End-Plate Material: Painted carbon steel.

G. Tie Rods and Nuts: Steel or stainless steel.

H. Plate Material: 0.5 mm Type 304 stainless steel.

I. Gasket Materials: Nitrile rubber (NBRHT).

1. Glue: Chlorine free.

J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.
1. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

K. Capacities and Characteristics: See Drawings.

2.3 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on floor.

2. Factory-fabricated steel supports to ensure both horizontal and vertical support of heat exchanger. Comply with requirements in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Pressure Relief Valves: ASME rated and stamped.

1. Pressure relief valve setting: 200 psig.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect heat exchangers according to ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME label.

B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Heat exchangers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install gasketed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

B. Install insulation over installed gasketed-plate heat exchanger.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.

C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers, and access to plates.

D. Install shutoff valves at heat-exchanger inlet and outlet connections.

E. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

F. Install hose end valve to drain shell.

G. Install thermometers on heat-exchanger inlet and outlet piping, on both sides of the heat exchanger. Comply with requirements for thermometers specified in Division 23 Section "Meters and Gages for HVAC Piping."

H. Install pressure gages on heat-exchanger and heating-fluid piping. Comply with requirements for pressure gages specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 23 57 00

SECTION 23 82 39.16

ELECTRIC HORIZONTAL PROJECTION UNIT HEATERS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 01 05, Paragraph 1.05 - ENERGY CODE
B. Section 23 05 13 - ELECTRICAL WORK

1.02 SCOPE

A. Furnish and install unit heaters and appurtenances with sizes and capacities as shown on the drawings.

PART 2 PRODUCTS

2.01 Electric horizontal projection unit heaters shall be furnished with heavy gauge steel housing coated inside and out with phosphate undercoat, electric heating elements with built- in automatic reset overheat protection, built-in thermostat, direct drive propeller fan, built-in magnetic contactor, built- in control transformer, and horizontal adjustable louvers. Units shall meet all UL and NEC requirements and bear UL label.

A. Manufacturer - Trane

2.02 Heater shall have sheathed finned tubular elements.

2.03 Provide built-in or remote thermostat as indicated on the drawings for control and a fan delay switch. Units with remote 24 volt thermostats shall have an internal 24 volt control transformer. Units with remote mounted line voltage thermostats shall be furnished with single pole thermostat kits.

2.04 Furnish units with ceiling mounting brackets.

2.05 Motors shall be continuous duty with built-in automatic reset thermal overload protection, motor data as shown on the drawings.

2.06 Electric horizontal projection unit heaters by Qmark, Berko or Brasch, of the same size, type and meeting capacity requirements may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Wiring by the Electrical Contractor.

3.02 Furnish auxiliary steel where required to support units.

END OF SECTION

SECTION 23 90 00
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.02 SUBMITTALS (Phase 2 Contractor will be furnished a complete set of submittals)

A. Submit under provisions of division.

B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; nameplate legends add the following product data.

1. Complete wiring diagrams. Wiring diagrams to include components within the speed controller enclosure.

2. Overall system efficiencies at 1/4, 1/2, 3/4 and full motor load, including the effect of line reactors.

3. Complete handling, installation, wiring, troubleshooting and maintenance instructions. To include full schematic diagrams for all printed circuit boards. Also to include complete parts and component listing for all printed circuit boards and factory service manuals.

4. Actual calculated nameplate ratings for both input and output currents reflecting specific installation.

5. Displacement and distortion power factors.

1.03 OPERATION AND MAINTENANCE DATA

A. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

B. Maintenance Data: Include routine preventive maintenance schedule.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle product to site under provisions of division.

B. Accept controllers on site in original packing. Inspect for damage.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with manufacturer's written instruction. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure and finish.

1.06 MAINTENANCE SERVICE

A. Furnish service and maintenance of controller for one year from Date of Contract Completion.

1.07 SCOPE

A. Provide Yaskawa Solid State variable frequency controllers to control new well pumps, condenser pumps, or other pumps.

B. All units to be supplied with manual electric by-pass to permit constant speed operation from AC line.

PART 2 PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. Furnish and install Yaskawa solid state variable frequency drives to vary the speed of the indicated 460 volt, 3 phase induction motors. System shall be microprocessor based, fully transistorized with a conservatively rated 3 phase, full wave diode bridge input and a PWM sine-coded output waveform. The input diode bridge will offer complete immunity against voltage dips, line noise and harmonics. The output transistors must be of the IGBT type (Insulated Gate Bipolar Transistor) to facilitate noiseless motor operation. The VFD’s will be tested and rated for a minimum of 28 years Mean Time Between Failure (MTBF).

B. The speed controller inverter to be suitable for motors driving fans and pumps. Rectifier to be full wave type. Displacement power factor to be 0.98 minimum. Maximum total harmonic distortion (THD) to be limited to 5 percent.

C. Input power is from a 460 volt, 3 phase, 4 wire, 60 Hz distribution system. Output power to the motor at 60 Hz to be nominally 460 volts.

D. Controller to be designed for continuous operation at any speed (frequency) within the specified frequency range. Controller design to be such that openings of motor leads and operation of protective features do not cause component failures. Linear speed control to be from 10 to 100 percent of maximum speed, unaffected by input voltage changes of plus or minus 10 percent rated voltage.

E. Controller to operate satisfactorily in ambient temperatures from 32°F to 104°F (0°C to 40°C). Controller to be equipped with mechanical means for cooling components and to handle operating in a dirty environment.

F. Output frequency to remain stable (at its operating point) in spite of input voltage, input frequency and temperature variations within the specified ranges.

G. Controller to provide for "soft" start, with adjustable starting frequency.

H. Provide the following features:

1. Frequency range 6 to 60 Hz output to the motor, in proportion to 0-10 volt DC or 4-20 mA signal input to the controller.

2. Self-contained unit in a NEMA 1 enclosure with gasketed doors and clear vision panel in each door to display LED indicators, including bypass filters, circuit breaker

3. Interfacing devices integral with the controller and connected.

4. Adjustable devices to positively limit the lower frequency (range 6 to 8 Hz minimum) and upper frequency (range 50 to 60 Hz minimum).

5. 3 Contactor bypass with input circuit breaker.

6. All Pilot lights to be LED type

7. Internal switches for "operate-service" select, output volts/hertz ratio, coast or ramp to start, and set point operation.

8. Provide LED indicator for ground fault indication.

I. Additional features:

1. Analog output signal: A voltage from 0 to 10 volt D.C., proportional to either output Hz, output voltage, or output amps.

2. LED status indicators for power on, enable trip, and LED's to indicate supplies are operating properly.

3. Auxiliary contacts with single pole, double throw contacts each rates 1 ampere at 115 volt AC for run indication, fault indication and bypass mode.

4. Provide input DC choke or line reactors.

J. Protective and miscellaneous features, to include:

1. Integral fuses as required to protect DC bus.

2. Power surge and spike protection (MOV's).

3. Output current limiting, without tripping by momentary overloads.

4. Instantaneous overcurrent tripping on phase to phase short circuits, high overloads and ground faults.

5. Undervoltage tripping on power or phase loss.

6. Overvoltage tripping.

7. Overtemperature tripping.

8. Visual indication of tripping causes (current limit, instantaneous overcurrent trip, undervoltage, overvoltage).

9. Overtemperature, decelerating limit.

10. Speed indicator.

11. Input molded case, thermal magnetic circuit breaker with through door interlock, lockable in open position.

12. DC injection breaking before start.

13. Hand-Off-Automatic selector switch.

14. Integral motor overload protection for the three legs, manually resetting bimetallic or eutectic alloy design, heaters sized for the motor.

15. A spare set of three fuses of each type and ampere rating.

16. Sets of dry form C contacts, actuated whenever the controller is operating the motor; refer to control contractor drawings for quantities, and use.

17. Compliance with IEEE 519 latest issue; provide filtering necessary to abate electrical noise.

18. Field adjustment devices for current limit, motor overload, acceleration rate, deceleration rate, maximum speed, minimum speed, speed input and offset gain.

19. Remote start/stop input terminals used to start the drive from the DDC system shall also be common to both the drive and the bypass. Provide quantity of drive and bypass status contacts as shown.

2.02 NAMEPLATES

A. Provide nameplates on all devices specified in this section.

B. Nameplates to match those used on existing equipment in Phase 1.

2.03 Variable Frequency Drives by Cutler Hammer or Allen Bradley of the same type, size, capacity and meeting other specified requirements may be furnished at the Contractor's option. The Cutler Hammer model shall be SV9000-NEMA12, while the Allen Bradley model shall be 1336+2NEMA12. *Products manufactured by these companies, but distributed under a different name will not be accepted.*

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

3.02 INSTALLATION

A. Install controller where indicated, in accordance with manufacturer's written instructions and NEMA ICS 3.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.03 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

3.04 ADJUSTING

A. Make final adjustments to installed drive to assure proper operation of system. Obtain performance requirements from installer of driven loads.

3.05 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.06 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

3.07 FIELD TESTS

A. Check control and interlocking wiring for proper operation, in the presence of the controls contractor, A/E and the City of Dublin.

3.08 WIRING

A. Each unit to be complete with all interconnecting wiring and connections between components within unit and to terminal board for connection to remote devices. Each wire to have an identifying number at each end.

B. Terminal Board: Each unit to be provided with terminal boards completely accessible from the front by which line, load, and control connections for unit may be made and disconnected. Each terminal board to have all terminals clearly marked and all wiring between terminals to be provided, including connections to all extra and unused terminals on auxiliary contacts, relays, and control devices, etc.

3.09 TESTING AND START-UP

A. Upon completion of installation, including piping and electrical connections, each component of each speed control device and its driven fans to be inspected, tested, adjusted, programmed, etc. and placed in operation by a factory trained service technician employed by the VFD manufacturer. Manufacturer to provide competent, well-trained supervisor to instruct the Unversity's operating personnel in the proper maintenance and care of the equipment. Instruction period, exclusive of installation and start-up time, to consist of one two-hour period for all equipment specified in this section of specification.

B. All VFDs furnished with the well pumps shall be started and commissioned by the well pump's representative.

END OF SECTION 23 90 00

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Separately coupled, vertically mounted, in-line centrifugal pumps.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

   1. Show pump layout and connections.
   2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
   3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Mechanical Seals: One mechanical seal for each pump.

PART 2 - PRODUCTS

2.1 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ITT Corporation Bell and Gossett or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Peerless Pump Company.
4. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
5. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet[, replaceable bronze wear rings, and companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Permanently lubricated ball bearings.

D. Shaft Coupling: Axially split spacer coupling.

E. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Cast iron.
c. Motor Bearings: Permanently lubricated ball bearings.

d. Efficiency: Premium efficient.

F. Capacities and Characteristics: See drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine hangers and supports bases for suitable conditions where pumps are to be installed; ensure vibration isolation is provided for pumps.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

1. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

3.3 ALIGNMENT

A. Perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check, shutoff, and throttling valves with memory stop on discharge side of pumps.

E. Install Y-type strainer and shutoff valve on suction side of pumps.

F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

G. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 23 21 23

SECTION 25 00 00

BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The existing building automation system (BAS) shall remain. Provide control modifications as needed for the new geothermal wall system that is replacing the cooling towers only. All other existing controls and hardware shall remain.

C. Materials furnished by the BAS contractor, but installed by others:

1. BAS Contractor to furnish the following to the Heating, Ventilation and Air Conditioning Contractor for installation by the HVAC contractor:

a. Control valves and temperature sensor wells for wet systems

b. Location of all wells and openings for temperature, pressure, and flow sensors for pipe systems.

c. Variable Frequency Drives

d. Refrigerant Pressure Sensor controls, for sensing refrigerant pressure between condenser and evaporator of the existing Trane chillers.

D. HVAC Contractor provides:

1. All wells and openings for water and air monitoring devices, temperature sensors, flow switches and alarms furnished by BAS Contractor.

2. Installation of all control valves as per the contract drawings. The temperature control contractor is not responsible for the incorrect installation of any hot or chilled water control valves.

4. All package unit control panels including but not limited to, factory well pumps, factory chiller panels (existing to remain), factory refrigerant control panels (existing to remain), refrigerant monitors and specialty interface modules.

E. Electrical Contractor provides:

1. Electrical Contractor shall provide dedicated 120 volt, 20 amp circuits and circuit breakers from normal and/or emergency power panel for each DDC Controller. Run power circuit within 5 feet of equipment installed and connected by BAS Contractor.

2. Electrical contractor will also provide smoke detectors, smoke detector wiring, and smoke damper interlock and power wiring for all life safety applications.

F. The City of Dublin provides:

1. Access to the existing controls central graphics workstation during normal business hours.

2. Access to existing graphics.

3. Access to existing sequences and programming language.

4. Logical names for BAS addresses.

5. Review of submittals.

1 .02 General Product Description:

A. The building automation system (BAS) is ____. The BAS shall integrate multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection utilizing the BACnet protocol.

B. The building automation system shall consist of the following:

1. Stand-alone peer-to-peer Building Controllers with 32 bit processors, a minimum of 2 MB of flash memory and 10 bit A/D converters. Ethernet connectivity is required for all Building Controllers.

2. Stand-alone peer-to-peer Application Controllers with 32 bit processors, a minimum of 1 MB flash memory and 10-bit A/D converters. Ethernet or MS/TP connectivity will be permitted for all Application Controllers.

3. Provide seamless interconnection to the existing central graphic workstation, and build/revise the existing BAS Controls including customized graphics displays in accordance with the existing formats.

C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Building Controllers, Application Controllers, expansion modules and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices. Alarm management and data collection that requires a single mechanism for user notification or viewing is strictly prohibited.

E. All Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device (peer-to-peer). All Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

1.03 RELATED WORK

A. Specified elsewhere:

1. 29 90 00 - Variable Frequency Drives

2. 23 01 05 - HVAC General Provisions

9. 23 05 93 - Tests and Adjustments

10. 23 05 13 – Electrical Work

1.04 QUALITY ASSURANCE

A. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

B. Install system using competent workers who are fully trained and factory certified in the installation of temperature control equipment. The factory certified diplomas shall be readily available at the request of the City of Dublin or A/E.

C. The complete installation and proper operation of the Building Automation Controls System shall include debugging and calibration of each component in the entire system and shall be the single source responsibility of supplier. The BAS shall be provided by the same controls contractor. All BAS controls contractors shall be Factory Authorized Distributors. The letting of separate contracts by the prime HVAC Contractor for the Control System and a separate contract for its installation by a third party installer is strictly prohibited.

E. All electronic equipment shall conform to the requirements of FCC Regulations, Part 15, Subpart B, Class A, governing radio frequency electromagnetic interference, and be so labeled.

F. BAS shall comply with, and be listed at time of bid for the following Underwriters Laboratories Standards:

1. UL 916 for Energy Management Equipment, per category PAZX for Energy Management Equipment.

2. UL 864 for Control Units for Fire-Protective Signaling Systems, per category UUKL for Smoke Control System Equipment.

G. Design and build all system components to be fault-tolerant.

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.

2. Static, transient and short-circuit protection on all inputs and outputs.

3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.

4. Network-connected devices to be AC-coupled or equivalent so that any single device failure will not disrupt or halt network communication.

5. All Building / System Controllers shall have real time clocks and data file RAM with battery and SRAM backup.

6. All controllers shall be EEPROM, flash driven.

7. The BAS Installer shall have a competent and factory certified Project Manager who is able to answer field questions, is aware of all schedules and schedule changes, and is responsible for the BAS Installer's work and the coordination of their work with all other trades. This Project Manager shall be available for on site and shall respond to design, programming, and equipment related questions. Submit project Managers Resume to the A/E and the City of Dublin for approval.

1.05 SUBMITTALS

A. Submit one complete set of drawings in hardcopy and one complete set of drawings in PDF format, showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original setpoints and calibration values, and setup parameters, and sequence of operation of the automation system. These drawings shall be submitted for approval to the A/E, together with a complete brochure describing the equipment and their functions and operation. Include all application software documentation (actual programs or their job-specific flow charts) with DDC system. The City of Dublin will review submittals and provide comments to the A/E as part of the approval process.

1. Manufacturer's Product Data:

a. All equipment components

2. Shop Drawings:

a. System wiring diagrams with sequence of operation for each system as specified.

b. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.

c. System configuration diagram showing all panel types and locations as well as communications network layout and workstations. Include control one-line diagrams for all systems.

B. Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the A/E prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. _____. (Existing system to remain)
B. No other Controls manufacturers are permitted, unless approved in advance by the A/E.

2.02 BACnet CONFORMANCE

A. The Building Automation System (BAS) contractor shall supply a BACnet (ANSI/ASHRAE 135-2004) compliant system. Each device category and its required compliance are listed below under sections F-H. BACnet compatible systems that employ the use of proprietary 'gateways' will not be accepted unless otherwise noted.

2.03 NETWORKING COMMUNICATIONS

A. Access to system data shall not be restricted by the hardware configuration of the building automation system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.

B. Local Area (communications) Network (LAN):

1. This communications network shall be limited to Building Controllers and Advanced Application Controllers and shall communicate bi-directionally with the BACnet peer-to-peer network. The LAN is existing to remain.

2.04 BUILDING CONTROLLER

A. The DDC (stand-alone) Controllers are existing to remain.

2.06 Advanced Application Controllers:

A. Provide Advanced Application Controllers as needed for stand-alone operation of the new plate-and-frame heat exchangers. Each Advanced Application Controller shall be compatible with existing controls. Provide for control of terminal equipment including, but not limited to, the following:

1. Plate-and-Frame heat exchangers, pumps, and control valves.

2. Existing Chillers

3. Other terminal equipment or monitoring

4. Equipment where not provided with internal controls capable of interface with the BAS.

B. Advanced Application Controllers must comply with existing BAS system, and must be peer-to-peer devices.

C. Each Advanced Application Controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event that communication with its Building Controller is lost and to insure protection during power outages.

2.08 WORKSTATION OPERATOR INTERFACE SOFTWARE

A. Basic Interface Description – the existing building interface is to remain. Modify the system as needed for the new HVAC equipment. Modify graphics to delete cooling towers and show heat exchangers/pumps.

2.09 FIELD DEVICES

A. Temperature Sensors: Each temperature sensor shall match the requirements of the associated temperature controller and shall be based upon 10-K Type-3 thermistors. Each sensor shall be designed for the appropriate application (i.e., duct, immersion, etc.) and be provided with all necessary installation accessories. Ranges shall be selected to the middle of the control range. Temperature sensors must have a minimum accuracy of +/- 0.5 deg F or .5 % of scale; whichever will provide the least error in measurement.

1. Electronic: A modulating solid state sensor with built-in detector, with continuous voltage or current output. Each sensor shall have individual setpoint adjustment. Input voltage shall be 24 VAC or less. Sensors shall be of matching type to the input detectors and output drives or sequencers.

2. Provide temperature sensors as required to meet the sequence of operation.

B. Automatic Control Valves: All control valves actuators shall be pneumatic. All valves shall be equipped with throttling plugs and removable composition discs and shall be manufactured by Siemens, Belimo, or Johnson Controls. All valves are to be sized by the Control Contractor and shall submit pressure drop calculations and guarantee sufficient size to meet the requirements of the equipment being served. Valve operators shall be of such design so as to provide adequate operating power for valve positioning.

1. Three-way Valves: Three-way valves are to be of the three port mixing arrangement, designed expressly for mixing of two inlets and providing a common outlet. The use of reverse piped diverting valves shall not be acceptable. The Temperature Control Contractor will assist the HVAC Contractor in providing guidance as to the correct method of piping of all three-way valves. It is the responsibility of the HVAC contactor to evaluate the contract drawings for proper verification.

2. Pressure drop through modulating control valves shall not exceed 7 psi and should be matched to the coil pressure drop whenever possible.

L. Pump Proof: Proof points for pumps will be accomplished through the use of current sensing relays at the motor control center or motor starters. Current sensing relays shall be split-core design, for installation over any single power lead. Current sensing relays shall include field adjustable set screw for amperage setpoint adjustment, and shall include integral LED status light to locally indicate the ‘on’ and ‘off’ condition.

M. Variable Frequency Drives: The Variable Frequency Drives (VFDs) shall be BACnet compatible. It is the responsibility of the BAS contractor to coordinate with the HVAC contractor to ensure that the proper drive is ordered with the appropriate native BACnet communications card (no gateways allowed).

2.10 LABELING

A. Provide labels for all field devices including sensors, transducers, thermostats, and relays. Exception: Room temperature and/or humidity sensors shall not be labeled.

B. Labels shall be black laminated plastic with white letters and adhesive backing or screw fasteners. Labels shall be located adjacent to device and permanently affixed to device mounting surface. Labels for sensors in pipes may be secured using chain around the sensor well.

C. Labels shall include system virtual/pseudo point name as well as English language name of device being controlled or specific condition being sensed.

D. Identify all control wiring at each end with a wire tags or labels machine print (no hand written).

E. Identify and label all control transformers by indicating all devices they power.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate final locations of all equipment and panels requiring power with the division 26 contractor.

3.02 ON-SITE TESTING

A. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The installer shall complete all testing, calibrating, adjusting and final field tests. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Upon completion of the work, notify the A/E that the system is ready for final tests and commissioning. The A/E and the City of Dublin shall be invited to all final testing.

B. At the time of final inspection, this the BAS Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Architect/Engineer, that his work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.

C. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Architect/Engineer, subsystems operate as coordinated and properly functioning, integrated system including the graphics, alarms and trending.

D. The Contractor shall furnish labor to provide adjustments and incidentals necessary to obtain the desired and intended results.

E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the City of Dublin at the conclusion of the one year warranty.

3.03 SERVICE AND GUARANTEE

A. General Requirements: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after completion of successful commissioning. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work.

B. Description of Work: The adjustment and repair of the system includes all computer equipment, software updates (including all firmware updates), transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.

C. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. City of Dublin shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

D. Systems Modifications: Provide any recommendations for system modification in writing to City of Dublin. Do not make any system modifications, including operating parameters and control settings, without prior approval of the A/E. Any modifications made to the

system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

E. Software: Provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the A/E and shall be incorporated into the operations and maintenance manuals, and software documentation.

F. As-Built Drawings: Submit 2 complete sets of drawings to the A/E shop bound in a three ring binder showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original setpoints and calibration values, and setup parameters, and sequence of operation of the automation system together with a complete brochure describing the equipment and their functions and operation. Include all application software documentation (actual programs or their job-specific flow charts) with DDC system. The contractor shall also provide two electronic copies of all as-builts to the A/E. The A/E shall submit one copy of the As-Built drawings to the City of Dublin for use during the final approval process.

1. Manufacturer's Product Data:

   a. All equipment components

2. Shop Drawings:

   a. System wiring diagrams with sequence of operation for each system as specified.

   b. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.

   c. System configuration diagram showing all panel types and locations as well as communications network layout and workstations.

G. Where installation procedures, or any part thereof, are required to be in accord with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the A/E prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

3.04 TRAINING

A. Following completion and acceptance of the on-site testing the Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 7:00 a.m. to 3:30 p.m. weekdays as follows:

B. Provide 4 hours of training for City of Dublin Building Automation personnel. Training shall include:

1. Explanation of drawings, operations and maintenance manuals

2. Walk-thru of the job to locate control components

3. Software, peripherals and panel communication procedures.

4. DDC Controller and ASC operation/function

5. Operator control functions including graphic generation and field panel programming

6. Operation of portable operator's terminal

7. Explanation of adjustment, calibration and replacement procedures

PART 4 SEQUENCE OF OPERATION

4.01. GENERAL

A. Provide a complete Building Automation System (BAS) which shall be programmed to achieve the following control sequences for the new HVAC equipment installed in the building. Modify existing building controls for chillers and new plate-and-frame heat exchangers and associated pumps as required for the new sequences. Contractor shall provide control programming previously approved by the City of Dublin wherever possible in order to achieve control sequences specified.

B. See Section 25 00 90 for Sequences of Operation.

END OF SECTION

SECTION 25 00 90
SEQUENCE OF OPERATION
(02SEPT14 EDITION)

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.

B. See Section 25 00 00, "Building Automation System" for hardware and submittal requirements for the BAS.

1.02 SUMMARY

A. This Section includes control sequences for new HVAC systems, subsystems, and equipment.

1.03 DEFINITIONS

A. DDC: Direct digital control.

B. VAV: Variable air volume.

1.03 SUBMITTALS

A. Submit one hard copy and one electronic (PDF) copy of control drawings showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original setpoints and calibration values, and setup parameters, and sequence of operation of the automation system. These drawings shall be submitted for approval to the A/E.

1. Shop Drawings:

a. System wiring diagrams with sequence of operation for each system as specified.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

PART 4 - SEQUENCE OF OPERATION

4.01. GENERAL

A. Provide a complete Building Automation System (BAS) which shall be programmed to achieve the following control sequences for the new HVAC equipment installed in the building. Modify existing building controls for chillers and associated pumps as required for the new sequences. Contractor shall provide control programming previously approved by the City of Dublin wherever possible in order to achieve control sequences specified.

B. All setpoints shall be adjustable.

C. All automatic control valves shall be pneumatic. All control valves shall be controlled via individual outputs.

D. All controls associated with the existing chillers to remain shall be closely coordinated with a factory-service technician. Contact Trane, Columbus, Ohio, office, to arrange for two days of factory-service technician's time to coordinate start-up and controls on the chillers.

4.02. CHILLED WATER COOLING SYSTEM

A. Chilled Water System Control:

1. Chilled water supply and return (primary and secondary pumps) is existing to remain, and shall not be changed as part of this project.

2. Condenser water supply and return shall be modified to remove all cooling tower controls and condenser water pump controls. Individual condenser water loops shall be provided for each chiller. Provide new condenser water controls as follows.

3. Chiller start-up shall be provided by the HVAC contractor in cooperation with a Trane factory-representative. Include two days of factory-service technician's time in bidding.

4. Chiller Condenser water pump on the chiller side of the heat exchanger shall be enabled on a call for cooling by the respective chiller, and shall run continuously.

5. Chiller Condenser water loop shall be provided with Trane "Cooling Tower Bypass (Run-Around Loop) controls. A 3-way valve in the piping from the condenser to the plate-and-frame heat exchanger shall modulate based on refrigerant differential pressure. The control system shall sense the difference between the condensing refrigerant and the evaporator refrigerant pressure. The differential pressure control will maintain condenser water temperature to the chiller as needed to maximize the chiller efficiency.

6. Geothermal water pump VFD shall be enabled on a call for cooling by the respective chiller, and shall run continuously. The pump shall be modulated up or down based on the condenser water temperature on the chiller condenser water piping running to the chiller condenser. Geothermal water flow through the heat exchanger shall be increased up to 100% if the setpoint water temperature (55 Deg. F.) is exceeded. The VFD shall be modulated to minimum speed (30%) whenever the condenser water is below setpoint.

7. The condenser water system set points shall adjustable by the operator at the graphics workstation. The chilled water system control panel will provide the capability to interface with the BAS to provide:

- Pump ON/OFF
- Plate-and-Frame temperatures on inlets and outlets
- Make-up water flow alarm (Condenser Water)

8. Status indication shall be provided for condenser water pumps and geothermal well pumps via current sensing relays.

4.04. HEATING HOT WATER SYSTEM (EXISTING TO REMAIN)

A. Heating Hot Water System: Heating Hot Water is not being modified as part of this project; all existing controls shall be maintained.

4.05 CENTRAL STATION AIR HANDLING UNIT

A. Air Handling Units: Existing building air handling units are not being modified as part of this project; all existing controls shall be maintained.

4.09 HEAT EXCHANGER ENCLOSURE HEATING AND VENTILATION

A. Exhaust – In-line fan on reverse acting thermostat shall run whenever the enclosure temperature exceeds 85 Deg. F.

B. Heat – Electric unit heater in the enclosure shall run whenever the enclosure temperature falls below 47 Deg. F.

4.10 MEASUREMENT AND VERIFICATION

A. Provide trend logs of condenser water supply, condenser water return, geothermal water supply, and geothermal water return temperatures.

B. Provide trend logs of all new pumps (run hours).

END OF SECTION

ELECTRICAL SPECIFICATIONS
INDEX

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SECTION 26 00 10
GENERAL PROVISIONS

PART 1 GENERAL

1.01 REFERENCE

A. The General Conditions and other Contract Documents as set forth in the foregoing pages are hereby incorporated into and become a part of the Specifications for work under this title, insofar as they apply hereto.

B. All Specifications under this Division Title are directed to and are the responsibility of the Electrical Contractor. Unless other trades or persons are specifically mentioned, "Electrical Contractor" is inferred and intended.

1.02 CONTRACT DRAWINGS

A. The Drawings accompanying these Specifications are complementary each to the other and what is called for by one shall be as if called for by both.

B. Consult all Contract Drawings which may affect the location of equipment, conduit and wiring and make minor adjustments in location to secure coordination.

C. Wiring layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be changed; it refers only to the exact locations of conduit and equipment to fit into the building as constructed and with the coordination of conduit and other equipment with piping and equipment included under other divisions of the Specifications.

D. Coordinate layout of work with other trades. Make minor adjustments in location required for coordination. Locations of structural systems, heating work and plumbing lines shall take preference over locations of conduit lines where conflict occurs.

E. Other than minor adjustments, changes or deviations from what is shown on the Construction Documents shall be submitted for approval before proceeding with the work.

F. The location of outlets and switches shown on the Drawings is approximate, and the A/E shall have the right to relocate any outlets or switches before they are installed without additional cost.

1.03 MANUFACTURER'S DRAWINGS

A. The Contractor shall submit for review, within six weeks after date of contract, six (6) copies of manufacturer’s drawings and wiring diagrams. The submittals will be reviewed (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed. Before submitting a shop drawing or any related material, the Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting. The A/E shall assume that no shop

drawing or related submittal comprises unless Contractor advises otherwise via a written instrument which is acknowledged in writing back to the Contractor.

B. The shop drawings and all related materials shall be returned with comments provided that each submission has been called for and is stamped by this Contractor as indicated above. Submittals shall be returned without comment for material not specified or which has not been approved by this Contractor.

C. The review of Manufacturer's Drawings or Schedules shall not relieve the Contractor from responsibility for errors or omissions in Manufacturer's Drawings or Schedules and deviation from Construction Drawings or Specifications.

D. At the completion of the Job, before final payment is made, the Contractor shall submit six (6) copies of Manufacturer's "As-Built" Drawings. Included with the Drawings shall be The Operating and Maintenance Manuals as called for in Section 26 01 20.

1.04 JOB-SITE COPY OF DOCUMENTS

A. Maintain at the site, one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other modifications, in good order. The Drawings shall be marked to record all changes made during construction especially deviations made necessary to incorporate equipment different from base equipment specified. The field set of Construction Drawings shall be marked to record all changes made during construction and shall be submitted with the Operation and Maintenance Manuals upon completion of the work. Upon request additional sets of Drawings shall be made available for this purpose.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall be new and of a quality not less than the minimum specified.

B. Materials and equipment for which there are Underwriters' Laboratories Standard requirements, listing and labels, shall have listing of Underwriters' Laboratories and be so labeled.

2.02 GUARANTEES

A. The Electrical Contractor shall be responsible for all defects, repairs and replacements in materials and workmanship for a period of one (1) year after final acceptance.

B. Product guarantees greater than one (1) year shall be passed along for Full Benefit of the manufacturer's warranty.

2.03 QUANTITIES

A. Items may be referred to as singular or plural on the Drawings and in the Specifications. The Contractor is responsible for determining quantity of each item required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Furnish and install all necessary hangers, supports, straps, boxes, fittings and other similar appurtenances not indicated on the Drawings but which are required for a complete and properly installed system consistent with the Architectural treatment of the building.

B. This contractor shall inform themselves fully regarding peculiarities and limitations of space available for installation of materials and apparatus under this contract, and see that all equipment necessary to be reached from time to time for operation and maintenance are made easily accessible. Clearances, when possible, shall be greater than those required by code.

C. Working Clearances: At least 6'-6" clear headroom must be maintained in front of all electrical equipment. Provide a minimum of 3'-0" clear space in front of all electrical equipment and as wide as the equipment with a minimum of 2'-6" wide. The same clearance shall be required at the rear of rear access equipment.

3.02 WORKMANSHIP

A. Electrical work shall meet or exceed the standards of installation and workmanship set forth in the latest edition of the National Electrical Contractors Association publication entitled NECA Standard of Installation, except as otherwise modified in these specifications or shown on the Drawings.

B. The A/E or City of Dublin reserves the right to direct the removal and replacement of any item which, in their opinion, does not present an orderly, neat or workmanlike appearance, provided that such item can be properly installed in an orderly way by methods usual in such work, or which does not comply with the contract drawings or these specifications. This contractor, at no additional expense shall perform such removals or replacements when directed so in writing.

C. The Electrical Contractor shall at all times keep the premises in a neat and orderly condition, and at the completion of the work shall properly clean up and cart away debris and excess materials.

END OF SECTION

SECTION 26 00 20
WORK INCLUDED

PART 1 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, tools, transportation, incidentals and appurtenances to complete in every detail and leave in working order all items of work called for herein and shown on the accompanying Drawings.

B. It is the intent that the ensuing work shall be complete in every respect and that any material or work not specifically mentioned or shown on the Drawings, but necessary to fully complete the work, shall be furnished.

1.02 COORDINATION OF PLANS AND SPECIFICATIONS

A. Contact the A/E immediately if there is any question regarding the meaning or intent of either Plans or Specifications, or upon noticing any discrepancies or omissions in either Plans or Specifications.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 SITE VISITATION

A. The Bidder is suggested to visit the site and fully inform themselves of the conditions affecting the scope of their work. Failure to visit the site shall not relieve them from any responsibility in the performance of this Contract.

3.02 SUPERVISION OF WORK

A. The Electrical Contractor shall be in charge of the work, at all times during construction, a competent superintendent with a large experience in the work to be done under this Specification.

B. Refer to the Specifications covering all branches of the work and keep fully informed of the progress of the general construction. Install all work that is concealed and built into the building in place in sufficient time to insure proper location without delays to the work of the other trades. Properly attend the work during the process of building-in to prevent misalignment and damage.

3.03 EXISTING WORK AND DEMOLITION

A. Locate existing utilities prior to beginning work. Reroute or replace existing utilities where necessary to permit installation of the new work. Provide adequate means of protection during work operations. Any existing utilities damaged during construction shall be repaired, to their existing conditions at Contractor's expense.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during work operations, notify the A/E immediately for procedure directions.

C. Suitably and adequately protect the existing work within and immediately adjacent to, the new work areas from damage and injury during the process of installing the work under this Contract. Existing work that has been harmed, damaged or injured as a result of the Electrical Contractor's operations shall be repaired, restored or replaced at the Electrical Contractor's expense.

D. Revise existing wiring as indicated or required. Existing work which remains shall be left in first class condition and properly reconnected.

E. All lighting fixtures, receptacles, switches and exposed conduit in remodeled areas shall be removed and replaced new as indicated on the Drawings.

F. Branch circuit wiring from removed fixtures and receptacles shall be removed back to the source.

G. Reuse existing concealed conduit and flush mounted boxes when possible. All unused boxes shall be blanked-off. All new conduit and wire in remodeled areas shall be run concealed where possible.

3.06 CUTTING AND PATCHING

A. Avoid cutting of concrete, masonry and other work by use of inserts and sleeves, and when necessary shall be done by the Electrical Contractor with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.

B. This Contractor shall give the General Contractor locations and sizes of all openings required for the installation of electrical equipment before walls, etc., are started. If it becomes necessary to cut into new work because of the failure of this Contractor to notify the General Contractor, then the General Contractor shall coordinate any necessary cutting by this Contractor.

C. No cutting shall be done which will in any way reduce the structural strength of the building.

D. All cutting through poured concrete slabs and walls shall be done with core drills. No jack hammers will be allowed.

E. Patching shall match existing surfaces in kind and finish and shall be done by the General Contractor at the Electrical Contractor's expense. This includes patching existing ceilings and floors where required and patching holes left by removal of existing conduits, bus duct, equipment, etc. See GENERAL CONDITIONS.

F. Repair of damages, by this Contractor, to newly patched and refinished areas shall be done by the General Contractor at this Contractor's expense in kind to match existing condition.

G. All conduits, equipment, etc., that penetrates walls or floors shall have openings, sleeves, etc., filled and closed off to prevent the possible spread of fire or products of combustion through the wall or floor.

H. Where required to maintain fire rating, openings shall be sealed utilizing 3M Brand Fire Barrier Penetration Sealing systems. Fire barrier or fire stop systems from Crouse-Hinds, Thomas & Betts or Dow Corning may be used at Contractor's option. This includes holes left due to removal of existing conduit, bus duct, etc. Openings shall be temporarily fire-stopped until permanent fire stopping is done.

3.07 CLEANING AND PAINTING

A. All electrical equipment shall be kept dry and clean during the construction period. New electrical equipment shall be covered with fiberglass reinforced plastic sheeting as a minimum form of protection. Provide additional protection, if job conditions so require.

B. Interiors of all enclosures shall be thoroughly vacuumed, cleaned and all dirt and debris removed before installing trim or covers.

C. All finished surfaces of equipment furnished under this Contract shall be thoroughly cleaned of dirt and all scratched or damaged surfaces shall be touched up with matching materials before final acceptance of the work. No exposed ferrous metal surfaces shall be left unpainted. Touch-up all galvanized, if scratched, with two coats of aluminum paint.

D. All painting shall be performed by the appropriate trade's person at the expense of this contractor.

E. Prime and paint all steel hangers, boxes, straps, rods, etc. which are not provided with rust-protective finish or the protective finish is damaged in installation. Paint to be zinc chromate primer and aluminum bronze finish. This includes unfinished and mechanical spaces as well as "exposed to view" locations.

F. Prime and paint all wood mounting panels with two (2) coats gray flameproof paint, both sides and edges.

G. When all work is completed and has been satisfactorily tested and accepted, all fixtures, conduit and other exposed surfaces shall be thoroughly cleaned.

H. All lamps in all fixtures shall be installed new and the entire system shall be checked for satisfactory operation.

I. Dust must be held to a minimum when work is performed inside of the existing building.

3.08 EXCAVATION AND BACKFILL

A. Provide all excavation and backfill necessary to get the work in place. Such excavation shall be carried to dimensions and depths indicated or as necessary for the proper installation and completion of the work.

B. Remove all form work and debris before backfill is placed. Backfill to be brought to proper elevation and shall be puddled, tamped and thoroughly compacted. Finished grade shall be replaced in kind, i.e., sod, gravel, blacktop, concrete, etc.

C. Surplus earth removed from excavations shall be removed from the site by this Contractor, unless the General Contractor requests that it be retained as fill to establish rough grades.

D. All excavated areas shall be barricaded and properly protected.

3.09 UTILITY MARKING

A. Marking of City of Dublin Owned Utilities will require payment by the requested agency. City of Dublin regular rates is $39.85 per hour or $51.00 per hour overtime.

B. Outside design A/E, contractors, and construction managers must mail or fax (614-292-3389) their request to Service 2 Facilities, please make your request on company letterhead.

C. Clearly identify the areas to be marked and acknowledge acceptance of being billed for this service. Please provide a billing address and a contact person for the request. Provide the following information: requesting agency or company, contact name, agency or company, address, phone, fax, and email. The project, City of Dublin Project representative, project name, project number location for marking and deadline, date needed, specific locations of area to be marked at the time the request is entered, a work order number will be assigned for the records.

D. The work order number will report the date and time of the request for department records. The utilities will be marked within 72 hours of the request being submitted (excluding weekends and City of Dublin holidays). The City of Dublin will not permit any site work to proceed until utility marking has been completed.

E. There are public utilities on and around campus that may not be known to City of Dublin personnel. Contact the Ohio Utility Protection Service (1-800-362-2764) for the location of public utilities.

F. Color code – here is the color code from the Utility Location and Coordination Council of the American Public Works Association currently adopted by OSU;

a. Red – Electric power lines cables, conduit and lighting cables
b. Yellow – gas, oil, steam, petroleum, or gaseous materials
c. Orange – communication, alarm or signal lines, cables or conduit, tunnels
d. Blue – water, irrigation and slurry lines
e. Green – sewers and drain lines
f. Pink – temporary survey markings
g. White – proposed excavation

3.10 INTERRUPTION OF SERVICE

A. The Electrical Contractor shall organize their work so that the alterations and additions shall cause a minimum of interference and disturbance to the existing electrical distribution system. Arrangements shall be made before interrupting the service in any area. A written detailed method of interruption procedure indicating elapsed time required and time of interruption shall be prepared by the Electrical Contractor and submitted for approval 10 working days prior to any interruption of service.

B. All interruptions of service shall be made when the load is at a minimum. The Electrical Contractor shall include necessary cost for overtime labor where service interruptions are required to be outside of normal daytime working hours.

C. At no time shall the Electrical Contractor or their employees normally working on the project leave the facility during a time when any normally live circuits or feeders are disconnected.

D. All materials, connections and equipment for temporary control or power wiring to maintain continuity of service during construction shall be provided by the Electrical Contractor.

END OF SECTION

SECTION 26 00 30
CODES AND FEES

PART 1 GENERAL

1.01 CODES

A. All work performed under this Specification shall be done in accordance with the latest edition of the National Electrical Code as prepared and published by the National Fire Protection Association, National Electrical Safety Code, Standards of National Bureau of Fire Underwriters and any Federal, State Codes or Local Codes applying.

1.02 PERMITS AND FEES

A. The A/E shall secure the required structural, plumbing, HVAC, and electrical plan approvals from the Ohio Department of Commerce. The contractor shall obtain, maintain and pay for any permit, inspections, or license applicable to their trade. Refer to section 00 72 16, paragraph 2.9 for additional information.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

End of Section

SECTION 26 01 20
OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 OPERATION AND MAINTENANCE MANUALS

A. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. Submit preliminary copy 45 days following the receipt of all approved shop drawings. After final approval, provide three (3) copies of Operation and Maintenance Instructions for submittal to The City of Dublin. Refer to Division 01 for additional submittal requirements.

B. Format:

1) The Title page shall include the Title of the Project, Address of the Project, Date of Submittals, Name and Address of Contractor, Name of A/E Architect and Name of A/E Engineer.
2) Second page shall be the Index for the manual contents.
3) The first section shall include a copy of each approved shop drawing and submittal with an index at the beginning of the section.
4) The second section shall include a list that is the same as the submittal drawings of all equipment used on the project. List shall include each suppliers name and address.
5) The third section shall include Operating and Maintenance Instructions. Manufacturer's maintenance manuals for equipment furnished under this Contract shall include such items as parts lists, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.

6) Brief but complete instructions for routine maintenance of each device.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 OWNER PERSONNEL INSTRUCTION

A. After placing systems in operation, thoroughly instruct designated Universities personnel on operation and maintenance of all equipment and systems.

B. Provide a minimum of two (2) hours of total instruction. Instructions shall include:
1) Location of equipment and explanation of function.
2) Clarification and explanation of operating and maintenance manuals.
3) Coordination of written and verbal instructions so personnel understands each.

C. The Electrical Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the The City of Dublin or his representative and for notifying the A/E of the time at least 48 hours in advance. Refer to Division 01 for additional requirements.

END OF SECTION

SECTION 26 01 26
TESTS AND INSPECTIONS

PART 1 GENERAL

1.01 INSPECTIONS

A. Obtain all inspections required by all laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain certificates of such inspections and submit these to the A/E. Pay all fees, charges and other expenses in connection with inspections.

B. Before any electrical work is covered, the A/E will inspect the electrical work completed at that time.

C. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "Final" inspection by the A/E in writing. If more than one re-inspection is required after this final inspection, the Contractor shall bear all additional costs, including compensation for the A/E's additional necessary services. A final inspection will not be made until Operating and Maintenance Manuals and Test Reports are submitted and approved and all prior "Observation report" punch lists are completed, signed and returned to the A/E.

D. All work shall be inspected by the local authority having jurisdiction. Upon completion of the work, the Electrical Contractor shall furnish to the A/E, a certificate of inspection and approval from said Inspector before final payment to the Contract will be allowed. Fee for inspections shall be a part of this Contract.

1.02 OBSERVATION REPORTS

A. During the course of construction, the A/E will prepare "Observation Reports" with a list of items found to be in need of correction. The Contractor shall correct all items listed. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed and the lists signed and returned to the A/E prior to making the final inspection. After the final list is issued, the same procedure applies.

1.03 TESTS

A. When the A/E makes final inspection of all electrical work, he will order tests to be performed as deemed necessary. These tests may include operation of lights, cord reels, disconnect switches and other equipment, continuity of conduit system, grounding and insulation resistances and various system operations. This Contractor shall provide such assistance as required, including manpower and tools, to perform these tests and simulate control sequences. The Contractor, not the A/E, is responsible to turn on the systems and demonstrate they are operating properly.

B. Submit data taken during such tests to the A/E. Pay all necessary professional fees involved in required testing of equipment.

1.04 UNACCEPTABLE WORK

A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications or Codes specified, or accepted standards of good workmanship.

B. The Contractor shall promptly correct all work found unacceptable by the A/E whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the A/E's additional services made necessary thereby.

1.05 GUARANTEE

A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by the A/E. Refer to the General Conditions.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.01 LIGHTING

A. All lamps in all fixtures shall be installed new. The entire system shall be checked for satisfactory operation.

3.02 PHASE ROTATION

A. Prove that all electrical equipment is connected for clockwise rotation (A-B-C).

3.03 LOAD BALANCE

A. Prove that loads are balanced across all phases of panelboards.

B. Obtain optimum phase balance under full load condition by reconnection of panelboard feeders at the main switchboard. Any panelboards requiring circuit changes for balance shall reflect these changes in the panel directory and wire color identification. Color change can be made with colored tape at panel.

C. Pay special attention to prevent reverse rotation of motors during load balance and adjustments.

3.04 RESISTANCE AND CONTINUITY

A. Provide insulation and grounding resistance and ground continuity tests of feeders, branch circuits or equipment on demand.

B. Branch circuit and feeder equipment grounding shall have a resistance reading of 3 ohms or less.

3.05 CONNECTIONS

A. Prove that mechanical connections are torqued to manufacturer's recommended UL and NEMA standards on demand.

3.06 EQUIPMENT

A. Provide necessary electrical personnel and testing instruments as required to assist in installation testing.

END OF SECTION

SECTION 26 05 19
WIRE AND CABLE

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all wiring required to connect complete power, lighting, and grounding.

PART 2 PRODUCTS

2.01 STANDARDS

A. All conductors shall be stranded and of the AWG size and type shown on the Drawings. Where no size or type is shown, conductors shall not be less than #12 type XHHW, THHN or THWN. All conductors shall be copper and have 600 volt insulation, be UL listed and of an American manufacturer.

B. All conductors shall be stranded unless otherwise noted and conform to the latest edition of the Underwriters' Laboratories, Inc., "Standard for Rubber Insulated Wires and Cables" and the National Electrical Code.

C. No wire used for lighting or power shall be smaller than #12 AWG.

D. No wire used for control circuits shall be smaller than #14 AWG.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be continuous from box-to-box. No joints shall be permitted in the circuit other than in junction boxes or fixtures.

B. All make up connections to fluorescent lighting fixtures and all branch circuit conductors run in wiring channels of fluorescent lighting fixtures shall be THHN, THHW or XHHW and rated 90°C.

C. Equipment ground conductors shall be of the same insulation type as the circuit conductors.

D. All conductors of a circuit shall follow the same path through any openings in metal partitions within the enclosure.

E. The ampacity of all conductors shall be at least as great as the rating of the fuse or circuit breaker on the line side of the conductors. Note the ampacity reduction required by Code when more than three conductors are placed in a raceway.

1. All conductors for distribution and control equipment terminations shall be based on full 75°C ampacity.

2. All conductors for appliance and utilization equipment terminations rated 100 amperes or less shall be based on 60°C ampacity.

F. Provide cable supports for vertical raceways per NEC Table 300.19 (A).

G. Wiring shall be installed in separate conduits for the following systems:

1. All emergency and exit lighting.

2. Control wiring.

3. Auxiliary systems wiring.

H. Swab conduits free of moisture, dirt and grease before pulling wire. Care shall be exercised while installing wire in conduits so that conductor insulation will not be injured. No oils, grease or compounds other than Ideal "Wire Lube", "Yellow 77" or equal UL approved wire-pulling lubricants shall be used for pulling any conductors.

I. Remove all wire cut dead.

3.02 CONNECTIONS

A. All connections are to be made using pressure type terminals.

B. Where connections are to be made to devices or equipment under screw heads only, install insulated, crimp-type spade clips on the wire ends before the connections are made.

C. Devices shall not be used as through connection points. Where through circuits are involved, they shall be spliced in the box with a pigtail connected to the device.

D. Connectors shall contain only one wire unless they are listed for multiple conductors.

3.03 WIRE COLOR CODE

A. The following color code shall be used:

	120/208 Volt	480/277 Volt
Phase A	Black	Yellow
Phase B	Red	Orange
Phase C	Blue	Brown
Neutral	White	Gray
Equipment Ground	Green	Green with yellow

All control circuits shall be pink. On 3- and 4-way switches, the travelers shall be the same color as the phase used.

B. Conductors #10 AWG or smaller shall have insulation colored as noted above.

3.04 MARKING

A. All branch circuits shall be marked in the panelboard gutters. Markers shall indicate corresponding branch-circuit numbers.

B. Wire markers shall be Thomas and Betts vinyl tape type WM wrapped once around the wire with the adhesive sides placed together to form a flag.

C. Wire markers shall be installed when wire is pulled.

END OF SECTION

SECTION 26 05 26
GROUNDING

PART 1 GENERAL

1.01 SCOPE

A. All branch circuits over 100 volts shall include a Grounding Conductor sized in accordance with NEC Table 250.122, except not be smaller than #12 for power and lighting circuits and #14 for control circuits. All ground conductors shall be Green.

B. The Contractor shall test all system neutrals to prove they are free of grounds except at the source.

PART 2 PRODUCTS

2.01 GENERAL

A. All ground clamps shall be Penn-Union "GPL" type or similar by O.Z. or Burndy.

B. All cable connections to ground rods shall be by "Cadweld", "Thermoweld", or "Heliarc" welding process by using recommended molds, compound and correct gas mixtures.

C. Conduit grounding type bushing shall be T & B Series 3870 with appropriate size ground wire terminal.

D. Conduit for solitary ground conductors shall be rigid PVC non-metallic electrical conduit with U.L. label.

E. All panels shall be furnished with a copper ground bar similar to the neutral bar and having the same number, size and type of lugs. The ground bar shall be factory bonded to the panel tub above or below the neutral assembly, but shall not be in a gutter.

F. Enclosures, junction and pull boxes shall utilize a "panel" type ground bar or U.L. listed grounding lugs or screws, as the number of ground conductors dictates.

PART 3 EXECUTION

3.01 INSTALLATION

A. The ground conductor shall be connected to the neutral in only two locations - on the supply side of the service disconnect means per NEC-250-23 and on separately derived systems per NEC 250-26. Because the ground is lost through the transformer, it must be re-established by use of a grounding conductor, minimum size per NEC Table 250-94 (a), connecting the transformer secondary neutral point to the transformer enclosure and to the interior cold water system or to building structure ground.

B. All solitary ground conductors shall be run in rigid PVC non-metallic conduit except 500 MCM and larger insulated cables may be run exposed on walls or ceilings of Equipment Rooms. Solitary ground conductors shall not be placed through metallic sleeves or conduits and shall not be completely encircled by metallic hangers or supports.

C. All conduits entering switchboards and substations shall be bonded together with # 3/0 AWG wire connected to a conduit grounding bushing. These shall then be bonded to the ground bus in the equipment item.

D. All enclosures, boxes, fixtures, receptacles, etc., shall be grounded by being securely bonded to the grounding conductor. Boxes, conduit, etc., shall not be used as part of the grounding "conductor" system.

E. Enclosures not requiring a ground bar shall have all ground conductors connected together and a pigtail the size of the largest conductor bonded to the enclosure with a single ground connector used for no other purpose.

F. At each receptacle box, the ground conductor shall enter and connect, with normal wiring connector, to: 1) The ground pigtail to receptacle; 2) The ground pigtail to box ground screw; and 3) The outgoing ground conductor to next device, if not at end of run. Metal to metal contact between the device yoke and the outlet box is not acceptable as a bond for either surface mounted boxes or flush type boxes.

G. Motor terminal boxes shall be grounded by the use of manufacturer- supplied ground lug or by drilling and tapping a hole for a ground screw. Remove paint prior to making the connection.

H. Lighting fixtures shall be grounded by the use of a manufacturer- supplied ground lug or pigtail or by the use of ground clips fastened on bare metal that is free of paint.

I. Conduit system shall be electrically continuous. All locknuts shall cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps. Where reducing washers are used and where concentric or eccentric knockouts are not completely removed bonding bushings shall be required.

END OF SECTION

SECTION 26 05 33

CONDUITS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all conduits, boxes, fittings, etc. for a complete raceway system.

B. See Division 26 Section, "Boxes and Plates".

PART 2 PRODUCTS

2.01 CONDUIT - Electrical Metallic Tubing (EMT)

A. All wiring in building interior including feeders, branch circuits and auxiliary wiring shall be run in thin wall (EMT) conduit.

B. All steel conduits shall be galvanized and have the manufacturer's name and U.L. label attached to or stamped on each piece.

C. Each section of conduit shall be straight, free from blisters and other defects and in 10'-0" lengths. Galvanizing shall be of such nature and so applied that it will not crack or flake when conduit is bent.

D. All conduit sizes stated in Specifications or marked on the Drawings are minimum size and shall be no less than ¾” unless otherwise noted.

2.02 CONDUIT - Rigid Metallic (RMC)

A. All exposed interior conduits below 8 feet, conduits on building exterior, or in Mechanical rooms shall be rigid or intermediate (IMC) steel.

B. Minimum size shall be no less than ¾”.

2.03 CONDUIT - Flexible Metallic (FMC & LFMC)

A. Flexible neoprene-clad galvanized steel conduit shall be used for "make-up" connections to rotating machinery and heating elements.

B. Lighting fixtures may be supplied with short lengths of flexible metallic conduit with green ground wire.

C. Minimum size shall be ¾” trade size.

2.04 CONDUIT - Rigid Non-Metallic (RNC)

A. Non-metallic conduit and fittings for concrete encasement shall be rigid PVC, power and communication type EB and UL Listed.

B. Non-metallic conduit and fittings for direct burial shall be rigid Schedule 40 PVC.

C. Non-metallic conduit and fittings specified or shown on the drawings for interior applications shall be rigid Schedule 40 PVC.

D. Non-metallic supports for grounding electrode conductor conduits shall be Burndy Nyloclip or by Clic.

2.05 CONDUIT FITTINGS - Metallic

A. All thinwall connectors shall be of the compression insulated-throat type, similar to Thomas and Betts No. 5223 (¾”). All fittings shall be steel. No die cast fittings will be allowed. Contractor may use Thomas and Betts, Raco, Steel City or Midwest fittings.

All rigid and IMC conduits shall have threaded connections.

A. All thinwall connectors shall be of the set screw insulated-throat type, similar to Thomas and Betts No. TC-722 (¾”). All fittings shall be steel. No die cast fittings will be allowed. Contractor may use Thomas and Betts, Raco, Steel City or Midwest fittings.

All rigid and IMC conduits shall have threaded connections.

B. Liquid-tight flexible metallic fittings shall be Midwest LTB-50. Flexible metallic fittings shall be Steel City XC-242.

C. "Mineralac" type supports and "Unistrut" type one bolt supports with square ends shall not be used at any location.

C. "Mineralac" type supports or "Unistrut" type one bolt supports of any design shall not be used below 9'-0" above the floor.

2.06 CONDUIT IDENTIFICATION - COLOR CODE

A. All emergency and exit lighting shall be installed in red conduit ¾” - 1” trade size.

B. All control wiring shall be installed in blue conduit ¾” - 1” trade size.

PART 3 EXECUTION

3.01 INSTALLATION

A. All rigid (RMC) or intermediate (IMC) conduit entering cabinets, pull boxes, junction boxes or outlet boxes shall be secured with double lock nuts and bushed ends.

B. No more than four (4) 90° bends will be allowed in any one conduit run. Where more bends are necessary in any single run, a pull box shall be installed. Pull boxes shall also be installed in long runs at a maximum separation of 100'-0". All conduit, except in concrete slab or earth, shall be routed parallel or perpendicular to the lines of the building. No out of plumb or diagonal lines will be accepted.

C. Unless otherwise noted, all conduits shall be run concealed within the building construction when installed in finished interior or exterior areas. Conduit in equipment rooms and on roof may be run exposed. Exposed wiring in finished areas shall be concealed in Wiremold.

D. All conduits shall be substantially supported by pipe straps, suitable clamps or hangers that are attached to the elements of the building structure to provide rigid installation. In no case shall conduit be attached to or supported from adjoining pipe, or installed in such a manner as to prevent the ready removal of other pipe for repairs.

E. Thomas and Betts "Ty-Rap" self-locking ties may be used to support conduits up to 1" which are running horizontally on top of small structural members or through bar joist.

F. Strap iron hangers and wire will not be approved as means of conduit support.

F. Heavy duty malleable iron or steel straps and hangers are permitted. For locations above grade that are subject to moisture penetration, corrosion-resistant steel straps and hangers are required. Perforated straps are not acceptable anywhere.

G. No conduit shall rest on or be supported from acoustical tile ceilings or the ceiling tile suspension system.

H. Exposed conduits rising from floor to surface panels or boxes shall have a 4" high concrete curb encasing the conduits at the floor line. Curb to have 45° chamfered edges.

I. No conduit shall be run in slab under boilers or similar heat producing equipment.

J. RNC conduit in poured concrete or buried beneath concrete slabs shall have a 1" minimum cover.

K. Where conduit runs across building expansion joints or where necessary to compensate for thermal expansion or contraction, expansion unions shall be provided.

L. Seal conduits with suitable, pliable compound where conduit enters colder section, such as refrigerating or cold storage area, to prevent circulation of air from warmer to colder section. Special sealing (i.e. hazardous) fittings are not necessary.

M. Exercise necessary precautions to prevent accumulation of water, dirt or concrete in conduits during execution of electrical work. Conduit in which water or foreign material has been permitted to accumulate shall be thoroughly cleaned or replaced where such accumulations cannot be removed.

N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Care shall be given that plugs or caps are installed before pouring concrete.

O. Flexible conduit may only be used as follows:

1. Lighting fixtures may be supplied with short lengths not longer than 6'-0".

2. Movable partition spaces may be supplied with any length.

3. Make-up connections to transformers may be supplied with lengths not longer than 2'-0".

4. All expansion joints, flexible connections and vibration isolators shall be bridged with short lengths not longer than 2'-0".

5. Old work area - flex conduit may be fished into existing walls in non-patient care areas.

P. All connections to rotating machinery and heating elements shall be made with short lengths, minimum 12", of liquid-tite conduit. Where motors are mounted on sliding bases, the flexible connection shall be long enough to allow full travel of the motor on the base, maximum 36".

Q. Install explosion-proof fittings required for hazardous locations, as indicated on the Drawings.

R. Pull Wires

1. A pull wire shall be installed in all empty conduits. In dry locations, pull wire shall be #14 gauge galvanized steel or nylon pull cord.

2. Both ends of all pull wires shall be identified by means of labels or tags, reading "PULL WIRE" and shall be numbered to refer to the same pull wire.

S. For remodeling and renovation projects, remove all conduits cut dead except where in concrete or masonry.

T. Seal all conduits entering from outside the building water and moisture tight.

End of Section

SECTION 26 05 34

BOXES AND PLATES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all outlet, junction and pullboxes as indicated on the Drawings and as necessary to install conduit and wiring in a neat and workmanlike manner.

B. Furnish and install all outlet and junction box covers and wiring device plates.

PART 2 PRODUCTS

2.01 STANDARDS

A. Pullboxes and junction boxes shall be galvanized and of the correct size and gauge in accordance with Code requirements and be U.L. listed.

2.02 BOXES FOR FLUSH WORK

A. Flush outlet, junction and pullboxes shall be pressed steel galvanized or sherardized and shall be a minimum of 4" square or octagonal similar to Appleton #40. Steel boxes cast in concrete shall be designed for concrete installation.

2.03 BOXES FOR EXTERIOR WORK

A. Boxes at exterior areas shall be watertight and dust-tight with gasketed covers.

2.04 BOXES FOR EXPOSED WORK

A. All boxes for exposed work in finished spaces shall be "FS" type with threaded hubs and rigid conduit riser.

B. All boxes for outlets and devices in unfinished spaces shall be steel 4-11/16".

2.05 BOXES FOR HAZARDOUS LOCATIONS

A. All explosion proof boxes shall be listed or labeled for hazardous locations where shown on the Drawings.

2.06 MULTIPLE GANG

A. Multiple gang switch boxes for 277-volt circuits shall have steel partitions between gangs.

PART 3 EXECUTION

3.01 INSTALLATION

A. All boxes shall be rigidly supported from building structure independent of the conduit system. Boxes cast into masonry or concrete are considered to be rigidly supported.

B. Close all unused and open knockouts with plugs of the proper size.

End of Section

SECTION 26 05 53
IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

A. All new individual circuit breakers, all disconnects, all starters, all exhaust fan starters, all cabinets and pull boxes for auxiliary systems such as telephone, communications, and emergency exit lights, etc., shall be identified on the front cover or trim with its name and/or designation number or letter as shown on the Drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. Identification shall be in the form of laminated plastic nameplates with black face and minimum ¼” high letters engraved into a white background. Plates shall be drilled on each end for sheet metal screw attachment. No "Dymo" or similar tape-type labels will be allowed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Plastic nameplates shall be attached to face of electrical device by sheet metal screws. Locate plate so wording reads horizontally and plate does not obstruct other identification plates, latches or operators.

B. Install nameplate at power receptacles where the nominal voltage between any pair of contacts is greater than 150 volts.

C. Per NEC 210.4(D), a phase color-code nameplate shall be mounted on the inside trim of the branch-circuit panelboards, adjacent to the manufacturer's nameplate. Refer to Specification section 26 05 19, “Wire and Cable” for proper color code for voltage utilized.

D. Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturer, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state: "Caution - Series Rated System."

E. All panel schedule directories shall be updated to reflect the circuit modifications made during the renovation. Directories shall be type-written.

END OF SECTION

SECTION 26 18 13 - FUSES

PART 1 GENERAL

1.01 SCOPE

A. Provisions of this Section shall apply to all fuses and fused equipment of 600 volts or less as shown on the Drawings.

B. Furnish and install all fuses as described below.

PART 2 PRODUCTS

2.01 STANDARDS

A. All fuses above 600 amperes shall be UL Class L, Bussman "Hi-Cap" Type KRP-C, or Littelfuse Type KRP-C, unless otherwise noted.

B. All fuses 600 amperes and below shall be UL Class RK-1, Bussmann "Lo-Peak" Type LPN/S-RK, or Littelfuse Type LLN/S-RK, unless otherwise noted.

PART 3 EXECUTION

3.01 VOLTAGE RATING

A. All fuses shall have proper voltage rating for the system voltage in which they are fused.

END OF SECTION

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piping system common requirements.
9. Equipment installation common requirements.
10. Painting.
11. Concrete bases.
12. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed 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.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

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

1.7 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 to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

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

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.; DMD Div.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. JCM Industries.
    e. Smith-Blair, Inc.
    f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Spears Manufacturing Co.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Colonial Engineering, Inc.
    b. NIBCO INC.
    c. Spears Manufacturing Co.

2. Description: MSS SP-107, PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities.

2. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.

   a. Pressure Rating: 150 psig minimum at 180 deg F (82 deg C).
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Water Technologies, Inc.

2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

   a. Pressure Rating: 150 psig minimum.
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.

c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.

a. Pressure Rating: 150 psig minimum.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
b. End Connections: Threaded.

2.4 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other Division 33 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 3/4 inch.
   1. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
   2. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

F. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

G. Lettering: Manufacturer's standard preprinted captions as selected by A/E.

H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

   1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

I. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
   1. Material: 0.0375-inch- thick stainless steel.
   2. Size: 1-1/2 inches in diameter, unless otherwise indicated.
   3. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

K. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

   1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
   2. Thickness: 1/8 inch, unless otherwise indicated.
   3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

L. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

   1. Green: Cooling equipment and components.
   2. Brown: Energy reclamation equipment and components.
   3. Terminology: Match schedules as closely as possible. Include the following:

      a. Name and plan number.
      b. Equipment service.

c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

M. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft.
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings.

2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

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

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

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

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

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC Pipe Sleeves: For pipes smaller than NPS 6.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Division 09 painting Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.

b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 5000-psi, 28-day compressive-strength concrete and reinforcement.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.10 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

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

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

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

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 21 00 - WATER SUPPLY WELLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Submersible multi-stage well pumps, for use in an NPDES Non-contact cooling water/well water system. All well water will be untreated, and not directly in contact with the HVAC system water or refrigerant.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PA: Polyamide (nylon) plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Tested Water Supply Well Performance Capacity: 300 gpm.

B. Well shall be 300 ft deep.

1.5 ACTION SUBMITTALS

A. Product Data: Submit certified performance curves and rated capacities of selected well pumps and furnished specialties and accessories for each type and size of well pump indicated.

B. Shop Drawings: Show layout and connections for well pumps.

   1. Wiring Diagrams: Power, signal, VFD, and control wiring.
   2. Setting Drawings: Include templates and directions for installing foundation bolts, anchor bolts, and other anchorages.
   3. Project Record Documents: Record the following data for each water supply well:

a. Casings: Material, diameter, thickness, weight per foot of length, and depth below grade.
b. Pumping Test: Static water level, maximum safe yield, and drawdown at maximum yield.
c. Log: Formation log indicating strata encountered.
d. Alignment: Certification that well is aligned and plumb within specified tolerances.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports, including the following:

1. Substrata formations.
2. Water-bearing formations.
3. Water levels.
4. Laboratory water analysis.
5. Performance test data.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each well pump to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Well Driller Qualifications: Wells shall be drilled by Cal Eger & Sons Pump Company, Plain City, Ohio, or another experienced water supply well driller licensed in the jurisdiction where Project is located. Well drillers shall be approved prior to bidding and included by addendum.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

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. Permits: Well Driller shall be responsible for filing ODNR drilling logs for all new wells drilled. The A/E shall obtain NPDES Non-contact cooling water permits, and the A/E shall also be responsible for submitting a Notice of Intent to the Ohio EPA. The City shall conduct monthly monitoring of the wells as required by the State.

1.9 PROJECT CONDITIONS

A. Well Drilling Water: Provide temporary water and piping for drilling purposes. Provide necessary piping for water supply. Coordinate water supply with the Owner and the local water department.

B. Based upon project geological conditions, local bedrock is anticipated at a depth ranging from 32 to 50 feet.

PART 2 - PRODUCTS

2.1 WELL CASINGS

A. PVC Casing: DR 21, 8 inch. ASTM F 480 PVC, Schedule 40 bell-and-spigot pipe and couplings for solvent-cemented joints.

B. Pitless Adapter: Fitting, of shape required to fit onto casing, with waterproof seals. Provide adapter as needed for 3" Yellow mine spline joint pump discharge riser pipe (100 LF) connected to the well pump.

C. Pitless Unit: Factory-assembled equipment that includes pitless adapter.

D. Well Seals: Casing cap, with holes for piping and cables, that fits into top of casing and is removable, waterproof, and vermin proof.

2.2 GROUT

A. Cement: ASTM C 150, Type II.

B. Aggregates: ASTM C 33, fine and coarse grades.

C. Water: Potable.

2.3 WATER WELL SCREENS

A. Screen Material: No screens are required for the bedrock well.

2.4 SUBMERSIBLE WELL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Grundfos or a comparable product by one of the following:
   1. Grundfos.
   2. ITT Industries; Goulds Pumps.
   3. Sterling Fluid Systems (USA) Inc.; Peerless Pump.

B. Description: Submersible, vertical-turbine well pump with the following features:

   1. Pump and Impeller Material: ANSI 304 Stainless steel, with built-in non-return valve on discharge.
   2. Motor: 3450 RPM, ANSI 304 Stainless steel, capable of continuous operation under water, with protected submersible power cable. Provide sand shield and liquid lubricated bearings with pressure-equalized diaphragm. Overall motor diameter shall not exceed six inches.

3. Column Pipe: Certa-Lock Yelomine SDR17 or equal, 250 psi rated. Galvanized piping is not permitted.
4. Discharge Piping: ASTM D 2239, SDR 11 PE pipe; made with PE compound number required to give pressure rating not less than 160. Include NSF listing mark "NSF pw."

    a. Insert Fittings for PE Pipe: Provide stainless steel fittings.

C. Capacities and Characteristics: See drawings.

2.5 MOTORS

A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Motor shall be provided with a factory variable frequency drive (VFD), in an IP 55 wet area rated enclosure, Grundfos CUE 2X380-500V or equal. The drive shall be provided with the following:
1. Control interface with programmable controls.
2. Analog input for external setpoint.
3. Analog input for sensor.
4. Four digital inputs
5. Two signal relays.
6. Well pump pressure transducer, furnished with the well controller.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pilot-Hole Data: Review pilot-hole test analysis furnished by Owner.

B. Neighborhood Well Data: Review operating and test analyses.

3.2 INSTALLATION

A. Construct well using rotary drilling and down-hole hammer rotary methods. The cased portion of the well shall be 12” +/- nominal diameter. The lower portion of the well bore shall be 7.5”-7.75” nominal diameter.

B. Take samples of substrata formation at 10-foot intervals and at changes in formation throughout entire depth of each water supply well. Carefully preserve samples on-site in glass jars properly labeled for identification.

C. Excavate for mud pit or provide aboveground structure, acceptable to authorities having jurisdiction, to allow settlement of cuttings and circulation of drill fluids back to well without discharging to on-site waterways.

D. Enlarge pilot hole and install permanent casing, screen, and grout. Install first section of casing with shale packer.

E. Set casing and liners round, plumb, and true to line.

F. Join casing pipe as follows:

1. Ream ends of pipe and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside casing before installation.
3. Cut bevel in ends of casing pipe and make threaded joints.
4. Clean and make solvent-cemented joints.

G. Mix grout in proportions of 1 cu. ft. sack of cement with 5 to 6 gal. of water. Bentonite clay may be added in amounts of 3 to 5 lb/cu. ft. If bentonite clay is added, water may be increased to 6.5 gal./cu. ft. of cement.

H. Place grout continuously, from bottom to top surface, to ensure filling of annular space in one operation. Do not perform other operations in well within 72 hours after grouting of casing. When quick-setting cement is used, this period may be reduced to 24 hours.

I. Provide permanent casing with 8” sanitary cap. Install with top of casing 18 inches above finished grade.

J. Develop wells to maximum yield per foot of drawdown.

1. Extract maximum practical quantity of sand, drill fluid, and other fine materials from water-bearing formation.
2. Avoid settlement and disturbance of strata above water-bearing formation.
3. Do not disturb sealing around well casings.
4. Continue developing wells until water contains no more than 2 ppm of sand by weight when pumped at maximum testing rate.

K. Install submersible well pumps according to manufacturer’s installation instructions and provide access for periodic maintenance.

1. Before lowering permanent pump into well, check for proper alignment and correct alignment problems. The well shall be sufficiently plumb, round, and straight to allow a 6.5” diameter x 20 ft long mandrel to pass the total depth of the well.
2. Start pump to verify correct rotation.
3. Securely tighten discharge piping joints.
4. Connect motor to submersible pump and locate pump within the lower section of the well casing, entirely within the protective PVC casing. Under no circumstances shall the pump be set below the casing.

    a. Connect power cable while connection points are dry and undamaged.
    b. Do not damage power cable during installation; use strap ties to secure the capable to the pump column pipe.

c. Install water-sealed surface cap.

3.3 CONNECTIONS

A. Piping installation shall meet requirements of the manufacturer's recommendations.

1. Connect piping between well pump and water piping.
2. Connect water distribution system in trench to well pipe at pitless adapter.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Test Preparation: Clean water supply wells of foreign substances. Swab casings using alkalis, if necessary, to remove foreign substances.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. Plumbness and Alignment Testing.
2. Furnish samples of water-bearing formation to testing laboratory.
3. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.
4. Performance Test Preparation: Start well pump and adjust controls and pressure setting. Replace damaged and malfunctioning controls and equipment.
5. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.

    a. Arrange to conduct tests, with seven days' advance notice, after test pump and auxiliary equipment have been installed. Note water-level elevations referred to for each assigned datum in wells.
    b. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of authorities having jurisdiction.
    c. Provide and maintain equipment of adequate size and type for measuring flow of water, such as weir box, orifice, or water meter.
    d. Measure elevation to water level in wells.
    e. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.
    f. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.
    g. Start and adjust test pumps and equipment to required pumping rates.

h. Record readings of water levels in wells and pumping rates at **30**-minute maximum intervals throughout 24-hour minimum period.
i. Record maximum yields when drawdown is 20 feet.
j. Operate pumping units continuously for eight hours after maximum drawdown is reached.
k. Record returning water levels in wells and plot curves of well recovery rates.

D. Water Analysis Testing:

1. Engage a qualified testing agency to make bacteriological, physical, and chemical analyses of water from each finished well and report the results. Make analyses according to requirements of authorities having jurisdiction.
2. Analyze water sample from each finished well for bacteriological, physical, and chemical quality and report the results. Make analyses according to requirements of authorities having jurisdiction.
3. Provide sanitizing in accordance with state of Ohio codes. (This well is for HVAC and irrigation use only, and does not require a health permit.)

3.5 PROTECTION

A. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.

B. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.

C. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.

D. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.

E. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

END OF SECTION 33 21 00