

City of Dublin
TRUCK WASH PROJECT

CITY OF DUBLIN, OHIO

BID AND CONTRACT DOCUMENTS

August 20, 2013

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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 September 10, **2013** at which time the sealed proposals will be opened by the **Facilities Manager**, for the following project:

City of Dublin Truck Wash 6351 Shier Rings Road

For all labor, materials and equipment necessary for the construction and associated site work for the City of Dublin Truck Wash as indicated within the plans and associated documents. A pre-bid meeting is planned for 11:00 a.m. on August 22nd at the Fleet Management Conference Room located at 6351 Shier Rings Road.

All work is to be included in the bid.

Service delivery shall be in accordance with contract documents.

City of Dublin
Truck Wash Project

The contract documents will be available for examination on August 20th 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.

Please note that the City of Dublin is bidding the Fleet Management Outbuildings Project and the Truck Wash Project concurrently. The City reserves the right to award these projects separately or as one total package.

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: **City of Dublin Truck Wash Project.**” The envelope shall bear the name and address of the bidder.

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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: City of Dublin Truck Wash 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 **Schaefer, Inc.** upon finding discrepancies or omissions in the bidding documents.

Direct inquiries and questions to:

Carrie Bremer, PE
PROJECT MANAGER
Schaefer, Inc.
815 Grandview Avenue, suite 250
Columbus, Ohio 43215

d: 614-706-5405
carrie.bremer@schaefer-inc.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.

PREVAILING WAGE DISKETTE

SECTION 2
BIDDING FORMS

City of Dublin
Truck Wash 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 **City of Dublin Truck Wash 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 **City of Dublin Truck Wash Project** shall be complete within **ninety (90) consecutive calendar days**, or as specified in bid documents unless an extension of time is granted by the **Facilities Manager**.

Please note that the City of Dublin is bidding the Fleet Management Outbuildings Project and the Truck Wash Project concurrently. The City reserves the right to award these projects separately or as one total package.

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.

City of Dublin
Truck Wash Project

Liquidated Damages:

| <u>Contract Amount</u> | <u>Dollars Per Day</u> |
|------------------------|------------------------|
| \$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.

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- 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 **City of Dublin Truck Wash Project** is subject to all of the provisions, duties, obligations, remedies and penalties of Ohio Revised Code Chapter .

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 **City of Dublin Truck Wash Project** with the City of Dublin, Ohio if awarded on the basis of this Proposal. If the Bidder does not execute an Agreement for **City of Dublin Truck Wash 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 _____, 2013.

City of Dublin
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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: () _____

City of Dublin
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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: () _____

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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:

City of Dublin
Truck Wash Project

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:

BID/PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned (the "Principal") and (the "Surety") are hereby 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:

City of Dublin Truck Wash 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 **City of Dublin Truck Wash 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.

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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 _____, 2013.

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
Truck Wash 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:

| <u>Taxes:</u> | <u>Penalties and Interest:</u> | <u>Counties:</u> |
|---------------|--------------------------------|------------------|
| \$ _____ | \$ _____ | _____ |
| \$ _____ | \$ _____ | _____ |
| \$ _____ | \$ _____ | _____ |

(Signature of Affiant)

(Print Name)

Sworn to and subscribed before me this ____ day of _____ 2013.

Notary Public

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 _____, 2013

Notary Public

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 _____, 2013

Notary Public

LIST OF SUBCONTRACTORS
Applicable X

NOTE: The bidder must perform at least 50% 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 _____, 2013 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 43016

City of Dublin
Truck Wash Project

CITY 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 _____, 2013.

Company Name: _____

Signature: _____

Print Name: _____

Title: _____

**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 services in connection with:

The labor, materials, and equipment required for the construction of new little league ball fields and associated site work including fencing, hardscape, landscaping, and electrical improvements.

FOR THE FOLLOWING:

**City of Dublin
Truck Wash Project
6351 Shier Rings Road**

The **ARCHITECT** of the Project is
**Carrie Bremer, PE
Schaefer, Inc.
815 Grandview Avenue, suite 250
Columbus, Ohio 43215**

**d: 614-706-5405
carrie.bremer@schaefer-inc.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: 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.

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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

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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 AIA 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 statutes 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

City of Dublin
Truck Wash Project

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:

SERVICE PROVIDER:

CITY OF DUBLIN, OHIO

By:

By: _____

Its: _____

Its:

Date: _____

Date:

APPROVED AS TO FORM:

Date:

Law Director

CERTIFICATION OF FUNDS

**City of Dublin Truck Wash Project
at 6351 Shier Rings 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
_____, 2013.
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: _____

Finance

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

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 _____, 2013.

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:

City of Dublin Truck Wash

Project Number:

Location: **6351 Shier Rings 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 _____.

City of Dublin
Truck Wash Project

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 _____, 2013.

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 _____, 2013.

This Change Order is signed this _____ day of _____, 2013.

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

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project consists of all items of Work as shown on the drawings and specified in the Project Manual.

- 1. Owner: City of Dublin
6555 Shier Rings Road
Dublin, Ohio 43016.
- 2. Owner's Representative: Brian Ashford
6555 Shier Rings Road
Dublin, Ohio 43016
Phone: 614.410.4790

- B. Type of Contract:

- 1. Project will be constructed under a single prime contract

1.3 CONCURRENT WORK

- C. The Owner has awarded separate contract(s) for the following construction operations at the Project site. Those operations may be conducted simultaneously with the work under this Contract.

- 1. City of Dublin Outbuilding Expansion: Construction of additional outbuildings and expansion of paved lot.

1.4 GENERAL REQUIREMENTS

- A. Section 01 11 00 - Summary Of Work
- B. Section 01 33 00 - Project Schedule
- C. Section 01 33 23 - Shop Drawings, Product Data, and Samples
- D. Section 01 50 00 - Temporary Facilities and Controls
- E. Section 01 74 00 - Cleaning and Waste Management

1.5 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
 - 1. Truck wash equipment as supplied by Hydro-chem Systems, Inc. and indicated in drawings provided for information only.
 - i. Keith Bailey
Hydro-chem Systems Inc.
5550 Clay S.W.
Grand Rapids, MI 49548
PH: (616) 531-6420
Fax: (616) 531-8692

1.6 CONTRACTOR USE OF PREMISES

- A. Access: Access to the site is restricted. Limit use of the premises to Work areas. Do not disturb portions of the site beyond the areas in which the Work is indicated. See also the requirements in Section 01 50 00 Temporary Facilities and Controls.
 - 1. Owner Occupancy: Allow for Owner occupancy and use of the building during the Work.
 - 2. Hours of work: Access to the Site shall be allowed and Work shall be performed between the hours of 7:00 am and 5:00 pm, Monday – Friday. Weekend work may be accommodated with upon request to the Facilities Manager of the City of Dublin.
 - 3. Parking: Owner will identify available parking areas for workers and equipment.
- B. Utility Interruptions: All interruptions of existing utility services shall be arranged with the Owner, utility company and existing users. All interruptions shall be scheduled with the Owner at least 2 business days prior to service interruption.

1.7 PERMITS AND FEES

- A. Contractor shall obtain and pay for all necessary permits, governmental fees, licenses and inspections required for the proper execution and completion of the Work.

1.8 SAFETY AND PROTECTION

- A. It shall be understood that the Engineer's on-site observations are not intended to include review of the adequacy of the Contractor's safety measures on or near the Project site.

- B. Compliance with all regulations pertaining to safety and health is the complete responsibility of the Contractor. The Contractor shall be completely responsible for safety and protective measures in order to protect persons and property. The Contractor shall comply with all OSHA requirements and all other governing requirements. The Contractor shall provide barricades, warning lights, fences, fall protection, and all other means necessary to protect the Owner, the Owner's employees, the public, the workers, and property from harm and damage. See also the requirements in Section 01 50 00 Temporary Facilities and Controls.

1.9 MANUFACTURER'S DIRECTIONS

- A. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as per manufacturer's printed specifications and directions, unless specified to contrary.
- B. Whenever trade or manufacturer's associations have published recognized standards applying to the use of materials and installation methods, the latest issue of such standards and recommendations shall, where applicable, govern the use of such materials and their installation unless otherwise specified.

1.10 DELIVERY OF MATERIALS AND STORAGE

- A. The Contractor shall be responsible for the unloading, checking and storage of all materials owned, assigned, to, or used by him or his Subcontractors in connection with the work.
- B. The Owner shall identify available storage areas.
- C. The Contractor and Subcontractors shall be responsible for the proper care and protection of all equipment and material delivered to the site.
- D. Any material or equipment which may be affected by the weather shall be covered and protected from the weather while being transported to the site, while stored on the site, and while incorporated in the Work.
- E. Damaged materials shall not be used in the Work.
- F. Should it become necessary at any time during the course of the Work to move stored materials which are to be used in the Work or equipment which has been temporarily placed on the job, then the Contractor or Subcontractor responsible for such materials or equipment shall move them or cause them to be moved without additional charge to the Owner.

1.11 CARE OF WORK

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- A. The Contractor shall adopt reasonable methods during the life of the Contract to furnish continuous protection to the site and to the Work, materials and equipment thereon to the end that loss or damage may be prevented. He shall be responsible for all damages to persons or property that occur as a result of his fault or negligence in connection with the prosecution of the Work and shall be responsible for the proper care and protection of all materials delivered and Work performed until completion and final acceptance, whether or not the same has been covered by partial payments made by the Owner.

1.12 CLEAN UP

- A. The Contractor shall remove from the premises all accumulation of debris, waste materials and rubbish caused by his employees or Subcontractors. See also the requirements in Section 01 74 00 Cleaning and Waste Management.

END OF SECTION 01 11 00

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SECTION 01 33 00 - PROJECT SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for special submittals required of the Contractor including the following:
 - 1. Project Schedule.

1.3 PROJECT SCHEDULE

- A. Promptly after being awarded a contract and before the start of the Work, the Contractor shall submit to the Owner, a schedule for performance of the Work.
The Owner reserves the right to make changes in the schedule in order to minimize disruption to the Owner's operations. If the Owner makes any changes to the schedule that affect the Contract Sum, such changes shall be agreed upon by the Owner and Contractor and shall be set forth in a Change Order prepared by the Engineer.

END OF SECTION 01 33 00

SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittal of Shop Drawings, Product Data, Samples.

1.3 SUBMITTAL PROCEDURES

- A. Contractor Review: The Contractor shall review and approve all submittals before transmitting them to the A/E. Each submittal shall bear the approval stamp of the Contractor or they will be returned by the A/E unchecked.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal to the A/E sufficiently in advance of scheduled performance of related construction activities to avoid delay.
 - 1. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - 2. Submit the shop drawings, product data, and samples called for in the specifications.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal to the A/E by use of a transmittal form. The A/E will return submittals received from sources other than the Contractor.
 - 1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, record deviations from requirements of the Contract Documents, including minor variations and limitations.
 - 2. Include the Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

1.4 SHOP DRAWINGS

- A. Submit newly prepared information, drawn accurately to scale. Do not reproduce Contract Documents or copy standard printed information as the basis of Shop Drawings.
 - 1. Include the following information on Shop Drawings:

- a. Dimensions.
 - b. Identification of products and materials included.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
2. Highlight, encircle, or otherwise indicate deviations from the Contract Documents on the Shop Drawings.
 3. Do not allow Shop Drawing copies that do not contain an appropriate final approval stamp by the Engineer to be used in construction.
 4. Submittal: An electronic file, in PDF format, of each required Shop drawing.

1.5 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Mark each copy to show which choices and options are applicable to the Project.
 1. Include the following information in Product Data:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
- B. Submittal: An electronic file, in PDF format, of each required Shop drawing .

1.6 SAMPLES

- A. Where samples are called for in the specifications, submit samples physically identical with the material or product proposed for use.
 1. Submit Samples for review of kind, color, pattern, or texture as required.

END OF SECTION 01 33 23

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for temporary construction facilities and controls, including temporary utilities, support facilities, and protection.
- B. Related Requirements:
 - 1. Section 011000-“Summary” for work restrictions and limitations on utility interruptions.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the regulations of OSHA.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- B. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes and odors from entering occupied areas.
- C. Project Signs: Unauthorized signs are not permitted.

1.5 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

1.6 TEMPORARY FACILITIES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Associate, occupants of Project, testing agencies, and authorities having jurisdiction.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to the Owner. The Owner will identify existing toilet facilities available for use.
 - 2. 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.
 - 3. 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.
 - 4. Parking: The Contractor's employees and any Subcontractor's employees shall park only in parking spaces designated by the Owner.
 - 5. Heating and Cooling: 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 temperature or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- B. If the Contractor or any Subcontractor requires temporary facilities other than as specified herein, they shall provide such temporary facilities as suits their needs at their own expense and in a manner satisfactory to the Owner.

1.7 SCAFFOLDING, HOISTS AND LIFTS

- A. The Contractor shall provide and pay for scaffolding, hoists, ladders, portable lifts, etc. as required for performance of the Work.
 - 1. Install and maintain all scaffolding, ladders, portable lifts, etc. in safe condition in strict conformance with OSHA and governing regulations.
 - 2. Prevent all scaffolding, hoists, ladders, portable lifts, etc. from being "attractive nuisances". Lock off all portable lifts when not in use and provide safety

barricades around scaffolding, ladders, and lifts to prevent unauthorized persons from climbing on scaffolding, ladders, and lifts.

1.9 BARRICADES

- A. The Contractor shall provide, pay for, and maintain in good repair during the Project period, all barricades, fences, and other means of protection around all areas of the Work and at all hazardous locations as necessary to safeguard the Owner, the Owner's employees, the public, the workers, and property. The Contractor shall provide such protection as required for safety and by law. At dangerous points throughout the work, the Contractor shall provide and maintain barricades, guard rails, colored flags, or other means to do everything possible to protect the Owner, the Owner's employees, the public, the workers, the premises, and adjoining property from injury or damage.
1. Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform the Owner, the Owner's employees, the workers, and the public of the hazard being protected against.
 2. The Contractor shall direct traffic safely around the site if traffic is affected by operations.
 3. The Contractor shall protect and maintain existing poles, wires, and other existing utilities and improvements. The Contractor shall contact the electric service provider to provide safety covers over exposed wires and conduits as required to safely proceed with the Work. The Contractor shall do everything else necessary to protect the workers and public from being shocked, electrocuted, or injured. Do not proceed with Work until safety measures are in place.
 4. The Contractor shall provide safety equipment for workers as required by OSHA and governing authorities, and shall comply with all governing regulations.

1.10 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
- C. Termination and Removal: Remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

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END OF SECTION 01 50 00

SECTION 01 74 00 - CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for cleaning of the Project Site.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and antipollution regulations.
 - 1. Do not dispose of volatile wastes in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

1.3 CLEANING OF THE SITE DURING WORK OPERATIONS

- A. Perform cleaning to ensure that premises and adjoining areas are maintained free from accumulation of waste materials and debris.
- B. Provide tarps, coverings, and whatever other means are necessary to prevent blowing and tracing of dust, dirt, and debris during operations.
- C. At daily intervals during the progress of the Work, clean the premises and adjoining areas and dispose of waste materials, debris, and rubbish caused by operations.
- D. All packaging devices such as cartons, cratings, boxes, bags, wrapping paper etc. which have been used to encase materials brought to the premises in connection with the Work shall be removed from the premises.
- E. Remove waste materials, debris and rubbish from site and legally dispose of off Owner's property.
- F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

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3.1 FINAL CLEANING OF THE SITE

- A. General: Provide final cleaning of the Project site.
- B. Complete the following cleaning operations before requesting final payment.
 - 1. Clean the Project Site, yard and grounds, in areas disturbed by Work activities of rubbish, waste material, litter, and foreign substances.
 - 2. Remove spills, stains, and other foreign deposits.
 - 3. Remove tools, construction equipment, machinery, and surplus material from the site.
- C. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

END OF SECTION 01 74 00

SECTION 0996600 –HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of high performance coating systems on the following interior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. All interior CMU wall surfaces in the area of work are to be coated with high performance coatings. The area of work for coating purposes are the bays in which the truck wash system is installed and is bounded by column lines 1 to 3 in the east-west direction and A-D in the north-south direction.

1.3 DEFINITIONS

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- B. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 5 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

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1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Benjamin Moore & Co. (Canada).
4. Bennette Paint Manufacturing Company, Inc.
5. Betonel Ltd.
6. BLP Mobile Paint Manufacturing.
7. California Paints.
8. Cloverdale Paint.
9. Color Wheel Paints & Coatings.
10. Columbia Paint & Coatings.
11. Conco Paints.
12. Coronado Paint.
13. Davis Paint Company.
14. Diamond Vogel Paints.
15. Dunn-Edwards Corporation.
16. Durant Performance Coatings.
17. Duron, Inc.
18. Envirocoatings Canada Inc.
19. Euclid Chemical Company.
20. Farrell-Calhoun.
21. Frazee Paint.
22. General Paint.
23. Hallman Lindsay Paints.
24. Hirshfield's, Inc.
25. ICI Paints.
26. ICI Paints (Canada).
27. Insl-x.
28. Kelly-Moore Paints.
29. Kwal Paint.
30. M.A.B. Paints.
31. McCormick Paints.
32. Microblend Technologies Inc.
33. Miller Paint.

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34. Mills Paint.
35. PARA Paints.
36. Parex LaHabra Inc.
37. Parker Paint Mfg. Co. Inc.
38. PPG Architectural Finishes, Inc.
39. Pratt & Lambert.
40. Rodda Paint Co.
41. Scott Paint.
42. Sherwin-Williams Company (The).
43. Sico, Inc.
44. Southern Diversified Products, LLC.
45. Smith Paint Products.
46. Vista Paint.
47. Zinsser.

- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated..
- C. Colors: As selected by Owner from manufacturer's full range

2.3 BLOCK FILLERS

- A. Block Filler, Epoxy: MPI #116.

2.4 PRIMERS/SEALERS

- A. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer

2.5 EPOXY COATINGS

- A. Epoxy, Gloss: MPI #77.
 - 1. Apply intermediate and top coats per manufacturer's recommendations.

2.6 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on recoating with complying materials, the two coats are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Masonry (CMU): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi (690 to 4140 kPa at 6 to 12 inches (150 to 300 mm)).

3.3 APPLICATION

- A. Apply coatings according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment.
 - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spatters by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by A/E, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced surfaces.

END OF SECTION 099600

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CITY OF DUBLIN
NEW AUTOMATIC TRUCK WASH

SBM PROJECT NO. 13007

Division 22 - Plumbing

| | |
|--|--------------------------|
| Section 22 05 00 – Common Work Results for Plumbing | 22 05 00-1 – 22 05 00-15 |
| Section 22 05 19 – Gauges for Plumbing Piping | 22 05 19-1 – 22 05 19-3 |
| Section 22 05 23 – General Duty Valves | 22 05 23-1 – 22 05 23-4 |
| Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment | 22 05 29-1 – 22 05 29-10 |
| Section 22 05 53 – Identification for Plumbing Piping And Equipment | 22 05 53-1 – 22 05 53-5 |
| Section 22 07 00 – Plumbing Insulation | 22 07 00-1 – 22 07 00-6 |
| Section 22 11 20 – Plumbing Piping | 22 11 20-1 – 22 11 20-9 |
| Section 22 41 50 – Plumbing Specialties | 22 41 50-1 – 22 41 50-4 |

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

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 materials and installation instructions common to most piping systems.
 2. Dielectric fittings.
 3. Plumbing demolition.
 4. Equipment installation requirements common to equipment sections.
 5. Supports and anchorages.
 6. Pipe trenching and backfill.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. The term "Contractor" as applied to work specified, shown or reasonably implied in the contract documents for Division 22 shall be defined as the subcontractor who is responsible for the work specified or indicated. All subcontracted work must be incorporated by and coordinated by the prime contractor.
- F. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 DESCRIPTION OF WORK

- A. Extent of plumbing related work required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Except as noted in this specification, this Contractor shall do all excavating and backfilling necessary to the work of this Division.
- C. This Contractor shall perform all painting incidental to this work.
- D. Furnish and install all miscellaneous steel required for supports, hangers, anchors, guides, etc., required for installation of equipment and materials furnished and installed under this Division. Steel shall be hot dipped galvanized unless otherwise noted.
- E. This Contractor shall perform all Division 22 related and indicated selective demolition including nondestructive removal of materials and equipment for re-use or salvage as indicated. Unless otherwise indicated, dismantle mechanical materials and equipment made obsolete by these installations. All equipment removed shall be offered to the Owner for his retention. If the Owner elects to retain equipment, it shall be turned over to the Owner at the site. If not, the equipment shall be removed from the premises by this Contractor.

1.5 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.

1.6 MECHANICAL COORDINATION

- A. This Contractor shall familiarize himself with the work to be done under other Divisions of this specification and their related drawings and shall so coordinate and schedule his work as not to cause delays or interference with the work of others. Such coordination and scheduling shall accomplish the installation of equipment and piping with a minimum of cutting through masonry and other adjustments.
- B. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with locations of doors. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

1.7 EXAMINATION OF SITE

- A. Before submitting a bid, each Contractor is requested to visit the job site to familiarize himself with construction conditions. No consideration or remuneration will be given for his failure to do so.

1.8 DIVISION 22 DESIGN DOCUMENTS

- A. Should it appear that there is a discrepancy between or within the drawings and/or specifications concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not clarified by Addendum during the bidding period, this Contractor shall base his bid on performing the work in the manner having the higher cost. The A/E shall have the option of selecting either of the manners shown and/or specified. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. Any discrepancies shall be called to the attention of the A/E before proceeding with work affected thereby.
- B. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment and piping unless dimensions are given. Drawings are not to be scaled.
 - 1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.
 - a. Provide at least the minimum manufacturer's recommended and code required clearance around the equipment for normal maintenance.
 - b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.
 - 2. Piping is to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional offset and fittings shall be provided as necessary to meet space constraints and to facilitate the work of other trades.
 - a. Recognizing the potential need for additional offsets and fittings in piping, the Engineer has included a safety factor in all friction

calculations. The Contractor is advised to plan and coordinate his work carefully to minimize the need for additional offsets and fittings. The Contractor shall be responsible to notify the Engineer of any and all modifications to systems which may affect the ability of equipment to serve its intended use prior to the purchase and installation of such equipment.

- C. All equipment, piping and material specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.
- D. If this Contractor proposes to install equipment requiring space conditions other than those as specified and/or shown on the design drawings, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall obtain the full approval of the A/E before proceeding with the work.

1.9 SHOP DRAWINGS

- A. Refer to the conditions of the Contract (General and Supplementary) and Division 01 Section: Shop drawings, product data, and samples for submittal definitions, requirements, and procedures.
- B. This Contractor shall review, stamp and sign with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information required by the contract documents. Shop drawings not stamped with Contractor approval will be returned for reprocessing.
 - 1. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.
 - 2. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included.
 - 3. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.
 - 4. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.

- C. In checking shop drawings, the A/E will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

1.10 CODES AND PERMITS

- A. All equipment, materials, and installation shall comply with the National Fire Protection Association's "National Fire Codes" and "National Electrical Code". Equipment shall bear the "UL" label as required by these codes.
- B. Install work in full accordance with rules and regulations of State, County and City authorities having jurisdiction over premises. This shall include safety requirements of Ohio State Department of Industrial Compliance. Do not construe this as relieving Contractor from compliance with any requirements of specifications which are in excess of Code requirements and not in conflict therewith. Sanitary waste and vent piping indicated may, in some instances, exceed code requirements. If drawings indicate individual wastes for each fixture, the drawings shall hold precedent over the Code as long as pipe sizing equals or exceeds prescribed waste and vent Code minimums.
- C. Submit, secure and pay for all permits and certificates of inspection incidental to this work required by foregoing authorities. Deliver all certificates to the A/E in duplicate.

1.11 INTERFERENCES

- A. Before installing any work, this Contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls or other structural members.
- B. Install additional offsets on piping where required to obtain maximum headroom or to avoid conflict with other work without additional cost to the Owner. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- C. Report any interferences between work under this division and that of any other Contractors to the A/E as soon as they are discovered. The A/E will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.

1.12 SHOP AREAS AND MATERIAL STORAGE

- A. No mechanical related trade is permitted to use as shop working area, any concrete slab that is to receive metallic waterproofing, asphalt tile, plastic tile, etc., except by expressed permission of the A/E.
- B. The Contractor shall make provisions for the delivery and safe storage of his materials and equipment in coordination with the work of others. Materials and equipment shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected. The arrival and

placing of large equipment items shall be scheduled early enough to permit entry and setting when there is no restriction or problem due to size and weight.

1.13 CLEAN-UP

- A. Refer to the Division 01 for general requirements for project cleaning.
- B. Insofar as the Mechanical work is concerned, at all times keep premises and building in neat and orderly condition follow explicitly any instructions of A/E in regard to storing of materials, protective measures, cleaning-up of debris, etc.
- C. Upon completion of work this Contractor shall thoroughly clean all apparatus furnished by him, pack all valves and thoroughly clean piping, fixtures, and equipment removing all dirt, grease and oil.

1.14 CUTTING AND PATCHING

- A. Do not endanger or damage installed Work through procedures and processes of cutting and patching. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
- B. Each contractor under this division shall perform cutting, fitting, and patching of building components and mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work;
 - 2. Remove and replace defective Work;
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
- C. See other sections of this specification for demolition requirements.

1.15 INTERRUPTION OF SERVICE

- A. When work progress makes temporary shutdown of services unavoidable, shutdown shall be coordinated with and approved by Owner so as to cause minimum disruption to established operating routine. Arrange to work as necessary to re-establish service within shortest possible down time. In those instances where the length of time required for the service interruption is not acceptable to the Owner, unless otherwise indicated, furnish and install temporary connections as required to reduce the length of time of service interruption to an acceptable level.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 EXCAVATING FOR DIVISION 22 WORK

- A. Backfill Materials:
 - 1. All backfilling within the building shall consist of an initial 12" layer of sand over the pipe. The remainder of the backfill shall be coarse interlocking aggregate or limestone screenings.
 - 2. All backfilling outside the building shall be selected dirt, free of large stones.

2.4 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for joining materials not listed below.
- B. 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 maximum thickness unless thickness or specific material is indicated.

Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

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- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. 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.
- 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.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. EpcO Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epcos Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.

- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

PART 3 -EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching".
- B. Disconnect, demolish, and remove plumbing systems and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PROJECT CONDITIONS, EXCAVATION AND BACKFILL FOR DIV. 22 WORK

- A. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during excavation operations.
- B. Notify proper authorities prior to commencing excavation. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- C. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by A/E and then only after acceptable temporary utility services have been provided.
 1. Provide minimum of 48-hour notice to A/E, and receive written notice to proceed before interrupting any utility.
- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
- F. Operate warning lights as recommended by authorities having jurisdiction.
- G. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
 1. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.
- H. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.

- I. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.
- J. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- K. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- L. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- M. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- N. Dewatering: Lay no pipe in water. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- O. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- P. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- Q. For pipes 5" or less in nominal size, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
- R. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- S. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.
- T. Do not backfill trenches until tests and inspections have been made and backfilling authorized by A/E. Use care in backfilling to avoid damage or displacement of pipe systems.

3.3 PREPARATION OF FOUNDATION FOR BURIED PIPING

- A. Grade trench bottom to provide smooth, firm, stable, and rock-free foundation throughout length of piping.
- B. Remove unstable, soft, and unsuitable materials at surface on which piping is to be laid, and backfill with clean material as specified.

- C. Shape bottom of trench to fit bottom of piping. Fill unevenness with tamped-sand backfill. Dig bell holes at each pipe joint to relieve bells of loads and to ensure continuous bearing of pipe barrel on foundation.
- D. Care shall be exercised to keep interior of buried piping free of dirt and foreign matter.
- E. Where trenching for pipe is excessively wide, the contractor shall, at his own expense, embed the pipe in concrete to support the added load of backfilling.

3.4 BACKFILLING

- A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.
- B. Install drainage fill where indicated, and tamp to uniform firm density.
- C. Backfill with finely-graded subbase material to 6" above wrapped, coated, and plastic piping and tanks, and to centerline of other tanks.
- D. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.
- E. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.

3.5 DISPOSAL OF EXCESS AND WASTE EXCAVATION MATERIALS

- A. Removal from Owner's Property: Remove excess excavated material, trash, debris and waste materials and dispose of it off Owner's property.

3.6 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 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 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 above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.

- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.

3.7 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 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. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. 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.
- F. 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.
- G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. 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.
 - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.
- H. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

- I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.8 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.
 - a. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.10 SELECTIVE DEMOLITION

- A. General: demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Protect adjacent materials indicated to remain.
- C. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
- D. Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- E. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for relocation or storage.
- F. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- G. The use of explosives in this work is prohibited.

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3.11 PUNCHLISTS

- A. From time to time throughout the course of the work, or upon completion of the work the A/E may perform site observations resulting in written documentation of deviations in the work from the Contract Documents. In such cases the Contractor shall respond in writing to each and every item on this written documentation stating the specific action taken to remedy the deviation. A response shall be provided by the Contractor for each separate observation. This work shall not be considered complete until such satisfactory written response is received by the A/E.

END OF SECTION 22 05 00

SECTION 220519 GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Gauges.
- B. Related Sections:
 - 1. Division 22, Section "Common Work Results for Plumbing".

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of piping and equipment specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. ANSI and ISA Compliance: Comply with applicable portions of ANSI and the Instrument Society of American (ISA) standards pertaining to the construction and installation of meters and gauges.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for gauges indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of gauge, signed by product manufacturer.

D. 1. PRODUCTS

1.6 PRESSURE GAUGES

- A. General: Provide pressure gauges of materials, capacities, and range indicated, designed and constructed for use in service indicated.
- B. Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
- C. Case: Drawn steel clear acrylic plastic lens, minimum 4-1/2" diameter above 6'-0" above floor, 3-1/2" below 6'-0" above floor.
- D. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service. Provide shutoff cock.
- E. Scale: White coated aluminum, with permanently etched markings.
- F. Range: Conform to the following. Where more than one range is indicated, select for normal operation at midpoint. Select all gauges for same service with same range.

1. Water: 0 – 200 psi.

- G. Manufacturer: Subject to compliance with requirements, provide pressure gauges of one of the following:

Ashcroft

Marsh Instrument Co.; Unit of General Signal.

Marshalltown Instruments, Inc.

Mijoco Corporation

Taylor

3M

Terice (H.O.) Co.

Weiss Instruments, Inc.

Winter's Thermogauges

1.7 PRESSURE GAUGE COCKS

- A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" female NPT on each end, and "T" handle brass plug.

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- B. Syphon: ¼” straight coil constructed of brass tubing with ¼” male NPT on each end.
- C. Snubber: ¼” brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
- D. Manufacturer: Same as for pressure gauges.

PART 2 - EXECUTION

2.1 GAUGE APPLICATIONS

- A. Locations: Install in locations as shown on the drawings.
- B. Pressure Gauge Cocks: Install in piping tee with snubber. Install siphon for steam pressure gauges.
- C. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

2.2 INSTALLATIONS

- A. Adjust faces of gauges to proper angle for best visibility.

2.3 ADJUSTING AND CLEANING OF METERS AND GAUGES

- A. Adjusting: Adjust faces of gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of gauges and factory-finished surfaces. Replace cracked, broken or severely scratched windows, repair any scratched or marred surfaces with manufacturer’s touch-up paint.

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL DUTY VALVES

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 DESCRIPTION OF WORK

- A. Extent of valves required by this section are indicated on drawings and/or specified in other Division 22 sections.
- B. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE

- A. Valve Types: Provide valves of same type by same manufacturer.
- B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- C. Codes and Standards:
 - 1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
 - 2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".
 - 3. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".
 - 4. ASME Compliance:

- a. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - b. ASME B31.1 for power piping valves.
 - c. ASME B31.9 for building services piping valves.
5. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.4 SUBMITTALS

- A. Include pressure drop curve or chart for each type and size of valve and strainer. Submit schedule showing manufacturer's figure number, size, location and features for each required valve and strainer. Indicate sizes being supplied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set globe valves closed to prevent rattling.
 4. Set ball valves open to minimize exposure of functional surfaces
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

1.6 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.

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- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

PART 2-PRODUCTS

2.1 VALVES

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections.
- B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
- C. Globe Valves 2" and smaller shall be 150# W.S.P., bronze, screwed pattern with rising stem, and union bonnet, and ANSI 420-S stainless steel tapered plug and seat. Valves shall conform to
- D. Ball valves installed in domestic cold water systems shall have an extended handle which offers vapor seal, adjustable memory stop, and valve packing maintenance without disturbing the insulation. This handle shall be equal to Nibseal by Nibco, Inc. The piping handle shall have a temperature range from -50 to 250 deg F.
- E. Ball Valves 2-1/2" through 3" size shall be 150 psi saturated steam rated; 600 psi non-shock cold water, oil or gas rated; two-piece body; chrome plated ball; blowout proof stem; reinforced TFE seats; conventional port design in all sizes; bronze or brass body; all 316 stainless steel trim on valve used for steam service; screwed pattern. Valves shall be Nibco 580-70, Apollo 70-100/200, Watts B-6000, Milwaukee BA-100S, or Legend T/S-1002 ST/TS-1002.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

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- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION OF VALVES

- A. Valves shall be provided in suitable locations at each item of equipment, branch circuit, riser, or section of piping as indicated or required for proper and safe operation of the system and to facilitate maintenance and/or removal of all equipment and apparatus. On horizontal pipe runs, install all valve stems vertically up where possible and in no case shall the stems be turned more than 90 degrees from the vertically up position.
- B. Install valves in compliance with manufacturer's installation instructions.
- C. Potable water systems (2" and smaller) shall utilize valves as indicated with soldered connections where used for zone isolation, or threaded connections when used in conjunction with a union for equipment isolation.

END OF SECTION 22 05 23

SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
 - 1. Division 22, Section “Common Work Results for Plumbing”.

1.2 DESCRIPTION OF WORK

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Types of supports and anchors specified in this section include the following:
 - Horizontal - Piping Hangers and Supports.
 - Vertical - Piping Clamps.
 - Hanger - Rod Attachments.
 - Building Attachments.
 - Miscellaneous Materials.

1.3 DEFINITIONS:

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, “Guidelines on Terminology for Pipe Hangers and Supports”.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of type and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. Code Compliance: Unless requirements are exceeded herein, comply with applicable codes pertaining to product materials and installation of supports and anchors.
2. Comply with NFPA 13 for hangers and supports used as components of fire protection systems. Include listing and labeling by UL and FM.
3. Factory fabricate hangers, supports, and components according to MSS SP-58.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support. For equipment curbs supply manufacturer's certified load bearing data. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 -PRODUCTS

2.1 HORIZONTAL - PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type of one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. Provide felt lined hangers or clamps for uninsulated refrigerant piping to eliminate transmission of sound and vibration. Perforated strap hangers shall not be used in any work.

2.2 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SSP-58, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

2.3 HANGER-ROD ATTACHMENT

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

2.4 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, expansion shells, inserts or beam clamps selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. All beam clamps shall be installed with a retaining strap to grasp two opposing sides of structure to prevent possible movement of the clamp due to vibration. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems. "C" clamps shall not be permitted except on fire protection piping.

2.5 MANUFACTURERS OF HANGERS AND SUPPORTS

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
- B-Line Systems, Inc.
 - Globe Hanger
 - ITT Grinnell Corp.
 - Michigan Hanger
 - Modern Hanger
 - PHD Manufacturing, Inc.

2.6 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards. Material coatings for interior use shall be electro-plated zinc (ASTM B633), or mill galvanized (ASTM A525 G90). For exterior use, materials shall be hot-dip galvanized after fabrication (ASTM A386).

- D. Bolts and Nuts: ASME B18.10 or ASTM A183, steel, hex-head, track bolts and nuts. Use galvanized or stainless steel for use in moist environments.

PART 3 -EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

3.3 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated below. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. For new concrete, install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.
- B. Two or one-end threaded rod sizing for various support loads shall be as follows:

| ROD DIAMETER | MAXIMUM LOAD (LBS.) |
|--------------|---------------------|
| 3/8" | 610 |
| 1/2" | 1130 |
| 5/8" | 1810 |
| 3/4" | 2710 |
| 7/8" | 3770 |
| 1" | 4960 |
| 1-1/8" | 6230 |
| 1-1/4" | 8000 |
| 1-1/2" | 11630 |
| 1-3/4" | 15700 |
| 2" | 20700 |
| 2-1/4" | 27200 |
| 2-1/2" | 33500 |

Note limitations on structure supporting rods.

- C. For reference purposes, the following table provides filled weights of steel piping for various sizes:

| PIPE SIZE | FILLED PIPE WEIGHT (LB/FT) |
|-----------|----------------------------|
| 1/2" | 1.0 |
| 3/4" | 1.4 |
| 1" | 2.1 |
| 1-1/4" | 3.0 |
| 1-1/2" | 3.6 |
| 2" | 5.1 |
| 2-1/2" | 7.9 |
| 3" | 10.8 |
| 4" | 16.3 |
| 6" | 31.5 |
| 8" | 50.2 |
| 10" | 74.6 |

Unless hanger spacing is

1. specifically indicated on drawings

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2. indicated in other Division 22 specification sections for special applications
3. required to be more frequently by State or local codes

all piping shall be supported at distances not exceeding the spacing in the following table. This table is intended for general distribution piping. Within equipment rooms, hangers must be arranged to provide full support of piping. No piping is to be supported by, or impose a load upon the equipment to which it is connected.

| HANGER SPACING TABLE | | |
|--|---|---|
| PIPING MATERIAL | MAX. HORIZONTAL SPACING (FEET)⁴ | MAX. VERTICAL SPACING (FEET)⁴ |
| ABS Pipe | 4 | 4 |
| Aluminum Tubing | 10 | 15 |
| Brass Pipe | 10 | 10 |
| Brass Tubing, 1-1/4" Dia. & Smaller | 6 | 10 |
| Brass Tubing, 1-1/2" Dia. & Larger | 10 | 10 |
| Cast-Iron Pipe ¹ | 5 | 15 |
| Copper or Copper-Alloy Pipe | 12 | 10 |
| Copper or Copper-Alloy Tubing, 1-1/4" Dia. & Smaller | 6 | 10 |
| Copper or Copper-Alloy Tubing, 1-1/2" Dia. & Larger | 10 | 10 |
| CPVC Pipe or Tubing, 1" Dia. & Smaller | 3 | 4 ² |
| CPVC Pipe or Tubing, 1-1/4" Dia. & Larger | 4 | 4 |
| Galvanized Steel Pipe | 12 | 15 |
| Lead Pipe | Continuous | 4 |
| PB Pipe or Tubing | 2.67 (32") | 4 |
| PVC Pipe | 4 | 4 |
| Steel Pipe | 12 | 15 |
| Steel Tubing | 8 | 10 |
| Gas Piping³ | | |
| Rigid Pipe, 3/4" Dia. and Under | 10 | ----- |
| Rigid Pipe, 1" Dia. & Over | 12 | ----- |
| Tubing, 1-1/2" Dia. & Under | 6 | ----- |
| Tubing, 1-1/2" Dia. & Over | 10 | ----- |
| Footnotes: | | |
| 1. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed. | | |
| 2. Install mid-story guide. | | |
| 3. Gas piping horizontal maximum hanger spacing shall be the lesser of that indicated for the specific material utilized or that indicated for gas piping. Maximum vertical spacing shall be that indicated for the material utilized. | | |

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| |
|-----------------------|
| 4. 1 foot = 304.8 mm. |
|-----------------------|

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Support plumbing piping independently of other piping.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provisions for Movement:
 - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- F. Pipe Slopes: Install hangers and supports to provide indicated or specified pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Horizontal Piping: Comply with the following installation requirements.
 - 1. Individual hangers for uninsulated piping not specified to be supported with roller hangers may be supported with either adjustable band hangers or adjustable steel clevis hangers.
 - 2. Individual hangers for insulated piping not specified to be supported with roller hangers shall be adjustable steel clevis hangers.
 - 3. Support the following horizontal piping using adjustable roller hanger supports MSS Type 43 for twelve (12) inches and below and MSS Type 41 for fourteen (14) inches and above:
 - a. All piping on horizontal trapeze supports.
 - 4. Heavy duty trapezes may be utilized for multiple horizontal pipes where applicable. Design of same shall be by trapeze manufacturer considering weight, available structure, pipe medium, material, etc. Supports for individual piping group on trapezes shall be as specified for individual piping.

- H. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: At contractor's option to shields, where flexible elastomeric insulation is indicated on piping size two (2) inches and under, attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

3.5 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 ADJUSTING AND CLEANING

- A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments and to achieve slope of pipe.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING 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. Pipe labels.
 - 2. Stencils.
 - 3. Valve tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

PART 2 - PRODUCTS

2.1 PIPING AND EQUIPMENT IDENTIFICATION MATERIALS:

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installers option, but provide single selection for each product category.

2.2 PAINTED IDENTIFICATION MATERIALS:

- A. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- B. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

2.3 PLASTIC PIPE MARKERS

- A. Snap-On-Type: Provide manufacturer's standard preprinted, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markets, complying with ANSI A13.1.
- C. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 deg F or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- D. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 deg around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Adhesive lap joint in pipe marker overlap.
 - 3. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
- E. Lettering: Comply with piping system nomenclature as described in ANSI A13.1 and abbreviated only as necessary for each application length.
 - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- F. Background Colors and Legend: Furnish piping identification in colors conforming to the following schedule:
- G. LEGEND WORDING MARKER COLORS

| | | |
|---------------------|---|----|
| Compressed Air | Y | |
| Domestic Cold Water | | GW |
| Plumbing Vent | | GW |
| Sanitary Drain | | GW |
| Sanitary Sewer | | GW |

Y = Yellow with Black Letters
GW = Green with White Letters
R = Red with White Letters
B = Blue with White Letters

2.4 PLASTIC TAPE:

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any of less than 6"), 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.5 VALVE TAGS

- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1-1/2" diameter tags, except as otherwise indicated.
- B. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick, engraved, color coded plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1-1/2" square tags with color coded lettering and backgrounds as required for the piping serviced. Provide a separate background color for each major piping group (e.g., chilled water, heating water, etc).
- C. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.6 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

Allen Systems, Inc.

Brady (W.H.) Co.; Signmark Div.

Industrial Safety Supply Co., Inc.

Lab Safety Supply

Seton Name Plate Corp.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
 2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
 3. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

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3.3 VALVE IDENTIFICATION:

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, and shut-off valves at plumbing

END OF SECTION 22 05 53

SECTION 22 07 00 - PLUMBING 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. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds, as applicable to this project.
- B. Related Sections include the following:
 - 1. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show typical fabrication and installation details for the following as applicable:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Attachment and covering of heat trace inside insulation.
 - 3. Insulation application at pipe expansion joints for each type of insulation.
 - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Removable insulation at piping specialties and equipment connections.
 - 6. Application of field-applied jackets.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

- B. Installer's Qualifications: Firm with at least 3 years successful installation experience on projects with mechanical insulations similar to that required for this project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site. Insulation made wet or damaged even after installation shall be removed and replaced.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
- B. Coordinate clearance requirements with piping installer for insulation application.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
CertainTeed Manson.
Knauf FiberGlass GmbH.
Owens-Coming Fiberglas Corp.
Johns Manville

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type I up to 850 deg F, (ASTM C547 Type II for operating temperatures from 850 to 1200 deg F), max k=0.25 at 100 F mean with factory-applied, all-purpose vapor-retarder jacket.
 - 2.
 - 3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.

2.3 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system. Unless otherwise indicated, furnish and install insulations of the same type for the same service throughout this work.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials clean and dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties. Insulate flanges, unions, strainer outlets and plug valves with pressure fit removable and replaceable covers. Do not restrict valve operation in any way.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: Taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder, and to seal fiberglass. No exposed fiberglass will be permitted.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 - 2. Seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
- B. Apply insulation to flanges as follows:
 - 1. Apply preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
 5. See flexible elastomeric insulation application for additional flange insulation information.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 3. Cover fittings with standard PVC fitting covers. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retardant mastic.
 4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
 3. Apply insulation to flanges as specified for flange insulation application.
 4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
 5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor retarder mastic.

6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.
7. See flexible elastomeric insulation application for additional valve and specialty information.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
 1. Inspect insulation assembly of fittings and valves randomly selected by A/E.
- B. Insulation applications will be considered defected if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.
- D. All wet or damaged insulation shall be removed and replaced.

3.6 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements. Where more than one material is indicated for a particular service, choice of listed material is installer's option, unless otherwise specifically indicated.

3.7 INTERIOR PIPE INSULATION APPLICATION SCHEDULE

- A. Domestic Cold Water Piping (35 to 60 deg F):
 1. Mineral fiber with vapor retardant all service jacket; 1 inch thick.

END OF SECTION 22 07 00

SECTION 22 11 20 - PLUMBING PIPING

PART 1 -GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

1. Potable water distribution, including cold-water supply.
 2. Plumbing drainage and vent systems.
- B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 22 Section "Common Work Results for Plumbing" for piping installation.
 2. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages and fittings.
 3. Division 22 Section "Identification for Plumbing Piping and Equipment" for labeling and tags.
 4. Division 22 Section "Plumbing Specialties" for plumbing system components.

1.3 DEFINITIONS:

- A. The following are industry abbreviations for plastic piping materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
 2. PE: Polyethylene plastic.
 3. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS:

- A. Provide components and installation capable of producing piping systems with the following minimum working pressure ratings, except where indicated otherwise:
1. Water Distribution Systems, Above Ground: 450 psig.

2. Soil, Waste, and Vent Systems: 10 ft. head of water, or as required by local code.

1.5 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Product data for plumbing piping products.

1.6 QUALITY ASSURANCE:

- A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.
- B. Comply with the provisions of applicable state, county, or local plumbing codes for materials, products and installation.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials", for plastic piping components. Including marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping, "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.
- D. Comply with NSF 14, "Plastics Piping Components and Related Materials", for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects", Sections 1 through 9 for potable-water piping and components.
- F. ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing. ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.

PART 2 -PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Couplings for Grooved-End Pipe and Fittings:

Grinnell Supply Sales Co., Grinnell Corp.
Gustin-Bacon Div., Tyler Pipe
Victaulic Co. of America

2. Copper Press Fittings:

Viega Company
Ridge Tool Company

2.2 PIPES AND TUBES:

- A. General: The application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems are indicated in Part 3 Article "Pipe and Fittings Applications"
- B. Hard Copper Tube: ASTM B 88, Types K AND L, water tube, drawn temper.
- C. Steel Pipe: ASTM A 53, Type S, Grade B, Schedule 40, galvanized, plain ends.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless, galvanized carbon-steel pipe.
- D. Polypropylene (PP) Plastic Pipe: ASTM F2389, plain ends.
- E. PolyVinyl Chloride (PVC) Plastic, DWV Pipe: ASTM D 1785, Schedule 40, plain ends.

2.3 PIPE FITTINGS AND TUBE FITTINGS:

- A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.
- B. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.
- C. Bronze Flanges: ASME B16.24, Classes 150 and 300.
- D. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball and socket joint, metal-to-metal seating surfaces, and solder joint, threaded, or solder joint and threaded ends.
 - 1. Threaded Ends: Threads conforming to ASME B1.20.1.
- E. Galvanized, Cast Iron Threaded Fittings: ASME B16.4, Classes 125 and 250, standard pattern, with threads conforming to ASME B1.20.1.
- F. Steel Pipe, Grooved-End Fittings: ASTM A 47 malleable-iron, ASTM A 106 steel, or ASTM A 536 ductile iron, galvanized, grooved-end fittings designed to accept couplings for grooved or shouldered joints.
- G. PolyVinyl Chloride (PVC) Plastic, DWV Pipe Fittings: ASTM D 2665, made to ASTM D 3311; socket type; drain, waste, and vent pipe patterns.
- H. Polypropylene (PP) Plastic, ASTM F 2389.

- I. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

2.4 JOINING MATERIALS:

- A. Solder Filler Metal: ASTM B 32. Alloy Sn95 or Alloy Sn94, approximately 95% tin and approximately 5% silver; or, Alloy Sb5, 95% tin and 5% antimony. Lead free.
- B. Brazing Filler Metal: ASTM A5.8, BCuP Series, copper-phosphorus alloys or BAgl, silver solder.

2.5 VALVES and STRAINERS:

- A. Refer to Division 22 Section "General Duty Valves for Plumbing Piping" for general duty valves and strainers.

PART 3 -EXECUTION

3.1 PIPE AND FITTINGS APPLICATIONS:

- A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.
- B. Water Distribution Piping Above Ground: Use the following as noted on the plans:
 - 1. 3 Inches and Smaller: Steel pipe, galvanized, having grooved ends, steel pipe grooved-end fittings, couplings for grooved-end ductile iron pipe and fittings, and grooved pipe and grooved pipe fitting joints.
 - 2. 3 Inches and Smaller : Polypropylene with solvent-cemented joints.
 - 3. 3 Inches and Smaller: Hard copper tube, Type L; wrought-copper or cast-copper alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.
- C. Soil, Waste, and Vent Piping Below Ground: Use the following:
 - 1. 2 to 4 Inches: Polyvinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
- D. Soil, Waste, and Vent Piping Above Ground: Use the following:
 - 1. 1-1/4 and 1-1/2 Inches: Polyvinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.

3.2 PIPING INSTALLATION, GENERAL:

- A. General Location and Arrangement: Drawings indicate general location and arrangement of piping systems. Install piping as indicated, except where deviations to layout are approved by the Engineer.
- B. Install components having pressure ratings equal to or greater than system operating pressure.
- C. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- D. Install piping free of sags and bends.
- E. Install interior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- F. Install piping tight to slabs, beams, joists, columns, walls and other building elements. Allow sufficient space around removable ceiling panels to allow for ceiling panel removal.
- G. Install piping to allow application of insulation plus 1 inch clearance around insulation.
- H. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- I. Install fittings for changes in direction and branch connections.

3.3 DRAINAGE AND VENT PIPING INSTALLATION:

- A. Install cast iron soil pipe and cast iron soil pipe fittings according to CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".
- B. Make changes in direction for drainage and vent piping using appropriate wye branches, wye branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-wye-branch and 1/8 bend fittings where two fixtures are installed back to back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- C. Lay buried building drains beginning at low point of each system, true to grades and alignment indicated, with unbroken continuity of invert. Place hub or bell ends of piping facing upstream. Install required gaskets according to manufacturer's recommendations

for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in piping and pull past each joint as completed.

- D. Install drainage and vent piping at the following minimum slopes, except where another slope is indicated:
 - 1. Sanitary Building Drain: 1/4 inch per foot (2%).
 - 2. Horizontal Sanitary Drainage Piping: 1/4 inch per foot (2%).
 - 3. Vent Piping: 1/8 inch per foot (1%).
- E. Install PVC drainage pipe and fittings according to ASTM D 2665.

3.4 JOINT CONSTRUCTION:

- A. General: Join pipe and fittings as follows:
 - 1. Ream ends of pipe and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt and debris for inside and outside of pipe and fittings before assembly.
 - 3. Solder Joints: Construct joints according to AWS "Soldering manual", Chapter 22 "The Soldering of Pipe and Tube".
 - 4. Brazed Joints: Construct joints according to AWS "Brazing manual" in the "Pipe And Tube" chapter.
 - 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter.
 - a. Damaged Threads: Do not use pipe or fittings having threads that are corroded or damaged.
- B. PVC DWV Pipe: Join PVC drainage pipe and fittings according to ASTM D 2665.
- C. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings with solvent cements.

3.5 CONNECTIONS:

- A. Supply Runouts to Fixtures: Install hot- and cold-water supply piping runouts of sizes indicated, but not smaller than required by plumbing code to fixtures.

- B. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts, with approved trap, of sizes indicated, but not smaller than required by plumbing code, to plumbing fixtures and drains.
- C. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
- D. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties".
 - 3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 FIELD QUALITY CONTROL:

- A. Inspect Water Distribution Piping as Follows:
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to time inspection must be made. Perform tests specified below in presence of the plumbing official.
 - 3. Roughing-In Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.
 - 4. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
 - 5. Reinspections: When a plumbing official finds that piping system will not pass test or inspection, make required corrections and arrange for reinspection by the plumbing official.
 - 6. Reports: Prepare inspection reports signed by plumbing official.
- B. Test Water Distribution Piping as Follows:

1. Test for leaks and defects in new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
 2. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.
 3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.
- C. Inspect Drainage Piping as Follows:
1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 2. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.
 - a. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.
 - b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
 3. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
 4. Reports: Prepare inspection reports signed by the plumbing official.
- D. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:
1. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is

performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test piping of plumbing drainage and venting systems on completion of roughing-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet of head of water. Water level shall not drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1 inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 PROTECTION:

- A. Place plugs in ends of uncompleted piping at end of day or when work stops.
- B. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of a water-based latex paint.

END OF SECTION 22 11 20

SECTION 22 41 50 - PLUMBING SPECIALTIES

PART 1-GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes plumbing specialties for the following:
 - 1. Water distribution systems.
 - 2. Soil, waste, and vent systems.
- B. Related Sections include the following:
 - 1. Division 22 Section "General Duty Valves" for general-duty valves and strainers.
 - 2. Division 22 Section "Gauges for Plumbing Piping" for thermometers, pressure gages.
 - 3. Division 22 Section "Plumbing Insulation" for insulation of water distribution piping and storm drainage.
 - 4. Division 22 Section "Plumbing Piping" for water-supply piping, drainage and vent piping connections.
 - 5. Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working pressure ratings, unless otherwise indicated:
 - 1. Water Distribution Piping: 150 psig.
 - 2. Soil, Waste, and Vent Piping: 10-foot head of water.

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1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
 - 1. Hose bibbs.
 - 2. Water hammer arresters.
 - 3. Trench drains.

1.5 QUALITY ASSURANCE

- A. Provide listing approval stamp, label, or other marking on plumbing specialties made to specified standards.
- B. Listing and Labeling: Provide electrically operated plumbing specialties specified in this Section that are listed and labeled.
 - 1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- C. Comply with ASME B31.9 "Building Services Piping," for materials, products, and installation.
- D. Comply with NFPA 70, "National Electrical Code," for electrical components.
- E. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

PART 2-PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wall Hydrants:
 - Josam Co.
 - Smith Industries, Inc.; Jay R. Smith Mfg. Co. Div.,
Tyler Pipe; Wade Div.
 - Watts Industries, Inc.; Ancon Drain Div.
 - Watts Industries, Inc.; Water Products Div.
 - Woodford Manufacturing Co.
 - Zurn Industries, Inc.; Hydromechanics Div.
 - Mifab, Inc.

2. Drains, Trench Drains, and Cleanouts:
 - Jonespec, Inc.
 - Josam Co.
 - Mifab, Inc.
 - Neenah Industries, Inc.
 - Proceptor, Inc..
 - Polycast, Inc.
 - Smith Industries, Inc.; Jay R. Smith Mfg. Co. Div.,
Tyler Pipe: Wade Div.
 - Watts Industries, Inc.; Ancon Drain Div.
 - Zurn Industries, Inc.; Hydromechanics Div.

2.2 HYDRANTS

- A. Piping specialties such as escutcheons, dielectric fittings, sleeves, and sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."

- B. Hose Bibbs: Bronze body, with renewable composition disc, 1/2- or 3/4-inch threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.
 1. Finish: Chrome or nickel plated.
 2. Operation: Wheel handle.

2.3 FLOOR DRAINS

- A. General: Size outlets as indicated on drawings.

- B. Floor Drains: ASME A112.21.1M, cast-iron body, with seepage flange and clamping device and secured cover. Floor drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Floor drains for use as area drains in exterior slab on grade may be furnished with anchor flange instead of seepage flange and clamping device.

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Schedule on drawings for shape, dimensions, strainer and body top finish, top-loading classification, sump size, and specific features.

- C. Trench Drains: ASME A112.21.1M, cast-iron body, with seepage flange and clamping device and secured cover. Trench drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Trench drains for use as area drains in exterior slab on grade may be furnished with anchor flange or other anchoring device instead of seepage flange and clamping device. See schedule on drawings for shape, dimensions, grate material, grate and body top finish, top-loading classification, sump size, number of outlets, and specific features.

PART 3-EXECUTION

3.1 FLOOR DRAIN INSTALLATION

- A. Install floor drains according to manufacturer's written instructions, in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Trap drains connected to sanitary building drain.
- D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- E. Position drains for easy accessibility and maintenance.

3.2 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or when work stops.

END OF SECTION 22 41 50

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CITY OF DUBLIN
NEW AUTOMATIC TRUCK WASH

SBM PROJECT NO. 13007

Division 26 - Electrical

| | |
|---|--------------------------|
| Section 26 05 00 – Basic Electrical Requirements | 26 05 00-1 – 26 05 00-7 |
| Section 26 05 01 – Basic Electrical Materials and Methods | 26 05 01-1 – 26 05 01-17 |
| Section 26 05 19 – Conductors and Cables | 26 05 19-1 – 26 05 19-5 |
| Section 26 05 26 – Grounding | 26 05 26-1 – 26 05 26-5 |
| Section 26 05 29 – Supporting Devices | 26 05 29-1 – 26 05 29-4 |
| Section 26 05 33 – Raceways and Boxes | 26 05 33-1 – 26 05 33-13 |
| Section 26 05 53 – Electrical Identification | 26 05 53-1 – 26 05 53-5 |
| Section 26 15 24 – Electrical Connections for Equipment | 26 15 24-1 – 26 15 24-5 |
| Section 26 24 16 – Panelboards | 26 24 16-1 – 26 24 16-5 |
| Section 26 27 26 – Wiring Devices | 26 27 26-1 – 26 27 26-4 |
| Section 26 51 00 – Interior Lighting Fixtures | 26 51 00-1 – 26 51 00-6 |

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1.-GENERAL

1.1. GENERAL REFERENCE:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to work of this section.
- B. Refer to Division 01 section "Alternates" for possible alternates affecting the extent of this Section of work.
- C. This Contractor is also referred to the Mechanical and all other drawings and specifications pertinent to this project. All of the above mentioned drawings and specifications are considered a part of the Contract Documents.
- D. This section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26 . It expands and supplements the requirements specified in sections of Division 01.

1.2. SUMMARY:

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:

- Shop drawings
- Definitions
- Discrepancies
- Record documents
- Coordination drawings
- Equipment
- Substitutions
- Codes and permits
- Interferences
- Delivery, storage and handling
- Operating and maintenance
- Punchlists
- Warranties

- B. Related Sections: The following sections contain requirements that relate to this Section:

- 1. Division 22 Section "ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT", for factory-installed motors, controllers, accessories, and connections.
- 2. Division 26 Section "BASIC ELECTRICAL MATERIALS AND METHODS", for materials and methods common to the remainder of Division 26 .

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1.3. SUBMITTAL COORDINATION MEETING:

- A. After a contract has been awarded for the project and prior to shop drawings being submitted, the A/E shall prepare a list of shop drawings that need to be reviewed with the material supplier prior to the material supplier submitting the shop drawings.
- B. The material supplier shall meet with the A/E in the A/E's office to review the drawings and specifications. The purpose of the meeting shall be to review the project specifications and drawings to make sure the submittals include all items shown in the contract documents.

1.4. SHOP DRAWINGS

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: Shop drawings, product data, and samples for submittal definitions, requirements, and procedures.
- B. This Contractor shall review, stamp and sign with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information and samples required by the contract documents. Submittal information not stamped with Contractor approval will be returned for reprocessing.
 - 1. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.
 - 2. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included.
 - 3. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.
 - 4. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.
- C. In checking shop drawings, the A/E will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.
- D. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be shown on shop drawings, and justification for their consideration must be included.
- E. Approval or acceptance of submittal items will not preclude rejection of those items upon discovery of defects in them prior to final acceptance of complete work.

- F. Shop drawings are required on the following items, where such items are a part of the Electrical Contract:
1. Lighting and appliance panelboards
 2. Interior lighting fixtures
 3. Lighting fixture ballasts.
 4. Lighting fixture lamps
 5. Wiring devices
 6. Equipment identification nameplates
 7. Fire stopping materials
- G. Where distribution panels are required, submittal to include one-line diagram showing all pertinent data such as bus size, bus material, protective device size, number of sections, meters, dimensions, interrupting rating, etc. Drawings to be executed in a professional manner and subject to A/E's approval.

1.5. DEFINITIONS:

- A. To achieve brevity in Specification and on Drawings, certain words and phrases not contributing to clarity have been omitted. Unless mentioned specifically as work to be done by Other Trades, all requirements contained in the Specifications and shown on the Drawings shall be performed by the Principal Contractor for this Division of the Contract. The following definitions shall apply:
1. Where the word "provide" is used in connection with a system, equipment, or item, it shall be construed to mean the furnishing and installing of the system, equipment, or item.
 2. Where the phrase "as directed" is used it shall be construed to mean as directed by the A/E or his authorized representative.
- B. The term "Contractor" as applied to work specified, shown or reasonably implied in the contract documents for Division 26 shall be defined as the subcontractor who is responsible for the work specified or indicated. All subcontracted work must be incorporated by and coordinated by the prime contractor.
- C. The term "Contractor" as applied to work specified, shown or reasonably implied in the contract documents for Division 26 shall be defined as the prime contractor who is responsible for the work specified, or indicated. All work subcontracted to each prime contractor must be incorporated by and coordinated by each prime contractor. The electrical prime contract for this project shall include the following:

| <u>Prime Contract</u> | <u>Specification Sections</u> | <u>Drawings</u> |
|-----------------------|-------------------------------|-----------------------|
| Electrical | 260500 through 265100 | All E-Series Drawings |

1.6. DISCREPANCIES:

- A. Should it appear that there is a discrepancy between or within the drawings and/or specifications concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not clarified by Addendum during the bidding period, this Contractor shall base his bid on performing the work in the manner having the higher cost. The A/E shall have the option of selecting either of the manners shown and/or specified. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the A/E before proceeding with work affected thereby.
- B. Should it appear that there is a duplication on the Drawings or in the Specifications, wherein the same work or items are shown or specified as being provided under different contracts, subcontracts or supply orders, and such duplication is not clarified by Addendum during the bidding period, it shall be assumed that the prime contractors have included duplicate quotations in their proposal to the Owner. The A/E shall have the option of selecting the contract, subcontract or supply order under which the work or items are to be provided and a credit shall be due the Owner for the duplicate work or items.
- C. Where a discrepancy exists within the specifications, among the drawings, or between the specifications and the drawings, refer to project supplementary conditions.
- D. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, electrical devices, etc. unless dimensions are given. Drawings are not to be scaled.
 - 1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.
 - a. Provide at least the minimum manufacturer's recommended and code required clearance around the equipment for normal maintenance.
 - b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.
 - 2. Raceways are to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional bends, pull and splice boxes shall be provided as necessary to meet space constraints and to facilitate the work of other trades.
- E. Electrical equipment, specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.
- F. Occasionally, certain references may be indicated on the Drawings to items which are suggested to be furnished and/or installed by various subcontractors. This is done to assist the applicable Prime Contractor in organizing his subcontractor's bids. However, no attempt has been made, nor is it implied, that this specification or plans are attempting to specifically

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divide all responsibilities for subcontractors. It is the Prime Contractor's responsibility that all items covered on electrical plans and Division 26 specifications are included in his bid and are coordinated with his subcontractors. No consideration will be given for Prime Contractor's failure to include all applicable electrical work in his bid.

- G. Where more than one manufacturer is named for major items of equipment, the manufacturer noted on the Drawings has been used as a basis for design. If another manufacturer is used, other than the one named on the Drawings, it shall be the responsibility of this contractor to ensure that the equipment will fit the space with all legal clearances, or bear the expense to change the space and structure to accommodate equipment used.

1.7. RECORD/AS-BUILT DOCUMENTS:

- A. Prepare record/as-built documents in accordance with the requirements of this division, and in Division 01.

1.8. EQUIPMENT INSTALLATION DRAWINGS:

- A. Prepare and submit for approval coordination drawings drawn to readable scale of all areas where equipment or materials are being used which are not the basis of specification and result in a change in the accessibility, performance, or serviceability of such equipment, or a conflict with other trades. Such equipment or materials shall not be installed until the installation drawings have been reviewed by the A/E and other Contractors.

1.9. COORDINATION DRAWINGS:

- A. Prepare and submit for approval coordination drawings as required in Division 01 Specifications and Project General Conditions. Equipment and materials shall not be installed until the coordination drawings have been reviewed by the A/E.

1.10. EQUIPMENT:

- A. Before entering into a contract, the successful bidder may be required to submit satisfactory evidence to show that an equipment manufacturer has been regularly engaged in the manufacture of such equipment for three (3) years and have not less than three (3) installations of a similar type which have been in successful operation under conditions similar to those specified for not less than two (2) years.
- B. When two or more items of same equipment are required (panelboards, switchboards, transformers, etc.) they shall be of the same manufacturer.

1.11. SUBSTITUTIONS:

- A. Refer to the Instructions to Bidders and the related Division 01 sections for requirements in selecting products and requesting substitutions.

1.12. CODES AND PERMITS:

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- A. All equipment, materials, and installation shall comply with the National Fire Protection Association's "National Fire Codes" and "National Electrical Code". Equipment shall bear the "UL" label as required by these codes.
- B. Install work in full accordance with rules and regulations of State, County and City authorities having jurisdiction over premises. This shall include safety requirements of Ohio State Department of Industrial Relations. Do not construe this as relieving Contractor from compliance with any requirements of specifications which are in excess of Code requirements and not in conflict therewith.
- C. Unless otherwise indicated, secure and pay for all permits and certificates of inspection incidental to this work required by foregoing authorities. Be responsible for payments to all public utilities for temporary service work performed by them in connection with provision of temporary service required under this DIVISION of specifications. Deliver all certificates to A/E in duplicate.

1.13. INTERFERENCES:

- A. Before installing any work, this Contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls or other structural members. If any work is so installed and it later develops that design cannot be followed, Contractor shall, at his own expense, make such changes in his work as the A/E may direct to permit completion of work in accordance with plans and specifications.
- B. Install additional conduit, pullboxes, spliceboxes, etc. where required to obtain maximum headroom or to avoid conflict with other work without additional cost to the Owner. Where mounting heights are not detailed or dimensioned, install electrical conduit and overhead equipment to provide the maximum headroom possible.
- C. Report any interferences between work under this division and that of any other Contractors to the A/E as soon as they are discovered. The A/E will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.

1.14. DELIVERY, STORAGE, AND HANDLING:

- A. The Contractor shall make provisions for the delivery and safe storage of his materials and equipment in coordination with the work of others. Materials and equipment shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected. The arrival and placing of large equipment items shall be scheduled early enough to permit entry and setting when there is no restriction or problem due to size and weight.

1.15. PUNCHLISTS:

- A. From time to time throughout the course of the work, or upon completion of the work the Design Professional may perform site observations resulting in written documentation of deviations in the work from the Contract Documents. In such cases the Contractor shall respond in writing to each and every item on this written documentation stating the specific action taken to remedy the deviation. A response shall be provided by the Contractor for each separate observation. This work shall not be considered complete until such

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satisfactory written response is received by the Design Professional. Contractor shall submit the responses to these items as part of the closeout documentation.

1.16. OPERATING AND MAINTENANCE:

- A. This Contractor shall furnish competent personal instruction to the Owner's operating personnel for a period of hours as indicated in individual Division 26 specification sections in the proper operation of the electrical equipment. He shall also supply the Owner with three (3) hardbound copies of an operation manual containing the following:
1. Step-by-step procedures for start-up and operation for each system and piece of equipment.
 2. Performance data, curves, ratings.
 3. Wiring diagrams.
 4. Manufacturer's descriptive literature.
 5. Manufacturer's maintenance and service manuals.
 6. Spare parts and replacement parts list for each piece of equipment.
 7. Name of service agency and installer complete with an emergency service phone number for nights, weekends and holidays.
 8. Final approved shop drawings.

1.17. WARRANTIES:

- A. Refer to the Division 01 Section: Specific Warranties for procedures and submittal requirements for warranties. Refer to individual equipment specifications for additional warranty requirements.
- B. This Contractor shall warranty all materials, workmanship and the successful operation of all equipment and apparatus installed by him for a period of one year from the date of the final acceptance of the entire work and shall guarantee to repair or replace at his own expense any part of the apparatus which may show defect during that time provided such defect is, in the opinion of the A/E, due to imperfect material or workmanship and not to carelessness or improper use. Compile and assemble the warranties specified in Division 26 into a separated set of vinyl covered three-ring binders, tabulated and indexed for easy reference.

PART 2.-PRODUCTS (Not Applicable)

PART 3.-EXECUTION (Not Applicable)

END OF SECTION 26 05 00

SECTION 26 05 01 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1.-GENERAL

1.1. RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods section apply to work specified in this section.

1.2. DESCRIPTION OF WORK:

- A. Extent of electrical related work required by this section is indicated on drawings and/or specified in other Division 26 sections.
- B. Except as noted in this specification, this Contractor shall do all excavating and backfilling necessary to the work of this Division.
- C. This Contractor is to coordinate all excavating and backfilling required under this Division with work specified under Division 02.
- D. See specification Division 09 for painting requirements. Coordinate all electrical painting work required. Coordinate protection requirements for electrical equipment which could be damaged by paint.
- E. Furnish and install all miscellaneous steel required for supports, hangers, anchors, etc., required for installation of equipment and materials furnished and installed under this Division. Steel used in a damp or wet environment shall be hot dipped galvanized unless otherwise noted.
- F. This Contractor shall furnish and install concrete foundations or bases under all electrical equipment that rests on floors, concrete encased ductbanks and exterior lighting fixture pole bases. He shall follow drawings and/or manufacturer's literature with regard to design and construction of same.
- G. This Contractor shall provide to the General Contractor, dimensions and special requirements for the concrete foundations or bases under all electrical equipment that rests on floors, concrete encased ductbanks and exterior lighting fixture pole bases. He shall follow drawings and/or manufacturer's literature with regard to design and construction of same.
- H. Furnish and install fire stopping for sealing around electrical penetrations through fire or smoke barriers, and floors.
- I. This Contractor shall perform all selective Division 26 related and indicated demolition including: Nondestructive removal of materials and equipment for re-use or salvage as indicated. All equipment removed shall be offered to the Owner for his retention. If the

Owner elects to retain equipment, it shall be turned over to the Owner at the site. If not, the equipment shall be removed from the premises by this Contractor. Refer to Division 02 Section "Selective Demolition" for additional requirements.

1.3. SUMMARY:

- A. This section includes a limited scope of general construction materials and methods pertaining to Division 26 applications of the following items:

- Excavation and backfilling
- Miscellaneous Metal
- Miscellaneous Lumber
- Concrete work
- Rough-ins
- Electrical installations
- Cutting and patching
- Fire stopping
- Selective demolition and alterations

1.4. PROJECT CONDITIONS:

- A. Conditions Affecting Demolition: The following project conditions apply:

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

- B. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by excavation.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.

- C. Notify proper authorities prior to commencing excavation. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping

respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

- D. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
 - 1. Provide minimum of 5 working days notice to Engineer, and receive written notice to proceed before interrupting any utility.
- E. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- F. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
- G. Operate warning lights as recommended by authorities having jurisdiction.
- H. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

1.5. SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including the recommended installation method, all in accordance with Division 01 and Section 260500 requirements.
- B. Electrical Penetration Seals: Submit the following:
 - 1. Shop drawings showing each condition requiring penetration seals. Indicate proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
 - 2. A copy of UL illustration of each proposed system indicating manufacturer approved modifications.
 - 3. Manufacturer's specifications, recommendations, installation instructions and maintenance instructions.

1.6. SEQUENCE AND SCHEDULING:

- A. Coordinate the shut-off and disconnection of electrical service and/or power with the Owner and the utility company. All associated work to be done at Owner's convenience.
- B. Notify the A/E at least 5 working days prior to commencing demolition operations.
- C. Perform demolition in phases as required by A/E.

PART 2.-PRODUCTS

2.1. EXCAVATING FOR ELECTRICAL WORK:

A. Backfill Materials:

1. All backfilling within the building shall consist of a 6" layer of sand under the conduit and a 12" layer of sand over the conduit. The remainder of the backfill shall be coarse interlocking aggregate.
2. All backfilling outside the building shall be selected dirt, free of large stones.

2.2. MISCELLANEOUS METALS:

- A. Fasteners: Zinc-coated, type, grade, and class as required.
- B. Metal Framing: As manufactured by Unistrut or Kindorf unless noted otherwise. Provide framing of sizes required by specific application.

2.3. MISCELLANEOUS LUMBER:

- A. Electrical backboards to be 5/8" thick ACX-EXT, Non-Com plywood. Paint both sides and all edges with grey fire-retardant paint.

2.4. MATERIALS OF CONCRETE WORK:

A. Reinforcing Materials:

1. Reinforcing Bars: Except as otherwise indicated, provide ASTM A 615, deformed, Grade 40 for size numbers 3 through 18; ASTM A 675, plain, Grade 60, for size number 2; sizes as indicated or required.

- B. Reinforcement Supports: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Provide wire bar type supports complying with CRSI recommendations, unless otherwise indicated.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ASTM C 33, except as otherwise indicated.
 - a. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used.

- b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" sieve.
3. Water: Clean and free of substances harmful to concrete.

2.5. DESIGN AND PROPORTIONING OF CONCRETE MIXES:

- A. General: Design electrical work concrete as follows, for each 28-day compressive strength class:

1. 4000 psi Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.35 water/cement ratio.

USE 4000 PSI CLASS FOR CONCRETE POLE BASES.

2. 3000 psi Class: 500 lbs of cement per cu. yd. (5.25 sacks), and 0.46 water/cement ratio.

USE 3000 PSI CLASS FOR EQUIPMENT PADS AND FOUNDATIONS.

3. 2500 psi Class: 450 lbs. of cement per cu. yd. (4.75 sacks), and 0.54 water/cement ratio.

USE 2500 PSI CLASS FOR CONCRETE DUCT BANKS.

4. Rough Grouting Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.60 water/cement ratio.

USE ROUGH GROUTING CLASS FOR GROUTING EQUIPMENT PADS ETC.

- B. Mix for Patching: Where electrical work requires patching of exposed concrete work which has been cut to accommodate electrical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

2.6. FIRE STOPPING MATERIALS:

- A. Fire stopping materials shall be intumescent safety barriers designed to block the spread of fire and smoke through penetrations created by electrical installations in fire rated walls and floors. Materials shall be flame, toxic fume and water resistant and shall have a minimum 3 hour fire rating. Fire rating shall be defined by tests conducted by ASTM, UL or other testing and inspection agencies acceptable to authorities having jurisdiction.
- B. Sleeves shall be Schedule 40, galvanized steel with plain end. Sleeves shall be no more than two sizes larger than single penetrating conduit. For multiple cable or conduit penetrations, make sleeve as small as possible to allow for penetrating items and firestopping material.

PART 3.-EXECUTION

3.1. EXAMINATION:

- A. Examine area and conditions under which basic electric materials are to be installed or methods are to be performed and notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to A/E.

3.2. EXCAVATION AND BACKFILLING:

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. provide and maintain dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- F. Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- G. Trenching: Excavate trenches for electrical installations as follows:
1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of raceways and equipment.
 2. Excavate trenches to depth as required.
 3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel to 6" below conduit.
- H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).
- I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
1. Under walks and pavements, use a course interlocking aggregate ODOT #6, 67, 68, 7, 78 or 8 or equivalent.
 2. Under building slabs, use a course interlocking aggregate ODOT #6, 67, 68, 7, 78 or 8 or equivalent.
 3. Under conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For raceways less than 30 inches below surface of roadways, provide 4-inch thick concrete base slab support. After installation of raceways, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. Other areas, use excavated or borrowed materials, free of large stones.
- J. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.

2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- M. Place backfill and fill materials evenly adjacent to structures, conduit, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Other Than Under Building or Pavement: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- O. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.
- 3.3. DISPOSAL OF EXCESS AND WASTE EXCAVATION MATERIALS:
- A. Removal from Owner's Property: Remove excess excavated material, trash, debris and waste materials and dispose of it off Owner's property.

3.4. ERECTION OF METAL SUPPORTS AND ANCHORAGE:

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.5. MISCELLANEOUS LUMBER:

- A. Cut, fit and place miscellaneous lumber fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Both sides and all edges of all lumber fabrications shall be painted with two (2) coats of grey fire-retardant paint unless noted otherwise.

3.6. INSTALLATION OF CONCRETE WORK:

A. Formwork:

- 1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be of required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.
 - a. Install chamfer strips at external corners of exposed concrete work.
 - b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.

B. Placing Reinforcement:

- 1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.
 - a. Place reinforcement to obtain at least minimum recommended coverages for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- 2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

C. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.
2. Strength-Class Application: Comply with the following general application requirements.
 - a. Plain Concrete Encased Ductbanks: Provide 2500 PSI class.
 - b. Reinforced Concrete Encased Ductbanks: Provide 3000 PSI class.
 - c. Underground Structural Concrete: Provide 3000 PSI class.
 - d. Concrete Pole Bases: Provide 4000 PSI class.
 - e. Miscellaneous Supported Work: Provide 3000 PSI class for electrical equipment pads and similar supported work.
 - f. Concrete Fill: Provide 2500 PSI class for filling structural steel foundation frames and for filling similar large-volume units.
 - g. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 PSI class concrete.
 - h. Patching General Concrete Work: Match concrete being patched.
3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
5. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
6. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (26.7 deg C), at time of placement.

Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.

7. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping.
8. Finishing Concrete Pole Bases: Remove all exposed formwork. "Sonotube" forms shall be removed to below depth of adjacent paving or grade whichever is applicable. Rub out entire surface of concrete pole base to smooth, uniform texture.
9. Surface Repairs:
 - a. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 - b. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

3.7. CONCRETE CURING AND PROTECTION;

- A. General: Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.

3.8. MISCELLANEOUS CONCRETE WORK:

- A. Concrete Grouting: Space approximately 1" thick between bottom of equipment and top of concrete foundation or base which remains after shimming, shall be filled completely with grouting. Grout shall be made up with sand and cement designed for the purpose which does not shrink on setting up. Exposed surface of grouting shall be finished to make a neat appearance. Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
- B. Concrete Bases: In the absence of more specific information, either on drawings, or manufacturer's literature, the bases shall be level, shall have a minimum height above finished floor of 3-1/2" and extend 3" beyond the base dimensions of the item of equipment.

- C. Concrete pads placed in existing structures shall be mounted securely to the original substrate with anchor bolts.

3.9. ROUGH-IN:

- A. Verify with A/E prior to rough-in, exact location of items such as switches, receptacles, clocks, speakers, fire alarm devices, floor boxes, surface-mounted raceways, etc., in finished areas.
- B. Verify with respective equipment supplier prior to rough-in, exact location and method of connection to respective equipment for such items as mechanical equipment, etc.

3.10. ELECTRICAL INSTALLATIONS:

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of electrical systems with exterior underground and/or overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.

10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Provide access panel or doors where units are concealed behind finished surfaces such as drywall and/or plaster construction, etc. Coordinate the access panel type with the A/E.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope (such as for underground services, etc.).
13. All wiring other than within an item of equipment, to be in raceways unless shown otherwise on Drawings or covered otherwise in these Specifications.
14. Raceways, boxes, cables, conductors, etc., installed in plenum spaces and similar areas shall be supported from the building structure and shall be installed symmetrical with the axis of the space (do not cross room at an angle). Support wires for lay-in type grid ceilings shall not be used to support electrical equipment, raceways, cables, etc. Use J-hooks rated to support communication cables.
15. Wiring of Motors and/or Equipment:
 - a. Provide necessary power wiring to motors and/or equipment where shown on Drawings.
 - 1.) Make final "line" connections to respective items of equipment as shown on Drawings.
 - 2.) Provide "Control" wiring, regardless of voltage, only when shown on Electrical Drawings.
 - 3.) In general, all 120, 208, 240, 277, or 480 volt wiring to be construed as power wiring; however, line voltage control wiring shall not be construed as power wiring unless shown on Electrical Drawings.
16. Wiring of Plumbing Equipment:
 - a. Provide necessary power wiring to plumbing equipment requiring same, where shown on Electrical Drawings.
 - b. Control equipment such as thermostats, pressure switches, etc., to be furnished, set in place, and wired by other Divisions, unless shown otherwise on Electrical Drawings.
 - c. Provide necessary disconnect switches, starters, or contactors where shown on Electrical Drawings. See "MOTOR CONTROL" section of these Specifications.

3.11. CUTTING AND PATCHING:

- A. General: Perform cutting and patching in accordance with Division 01 Section "CUTTING AND PATCHING". In addition to the requirements specified in Division 01, the following requirements apply:
1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Demolition of electrical items required to be removed from structure to remain.
 - b. Uncover work to provide for installation of ill-timed work.
 - c. Remove and replace defective work.
 - d. Remove and replace work not conforming to requirements of the Contract Documents.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the A/E, uncover and restore work to provide for A/E observation of concealed work.
 2. Cut, remove, and legally dispose of electrical equipment, components, and materials, including but not limited to electrical items to be removed and items made obsolete by the new work.
 3. Protect the structure, furnishings, finishes, and adjacent materials not to be removed.
 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 6. Patch new and/or existing finished surfaces and building components using new materials matching existing materials and using workmen skilled in respective trade.
 7. Where existing construction such as floors, walls, ceilings, etc., must be cut to relocate, remove or add raceways and/or equipment, such construction to be restored to original condition to satisfaction of A/E, by this Contractor using workmen skilled in respective trade.
 8. General penetrations through walls, floors, slab, etc. will be patched with materials to match the surrounding surface (i.e. vinyl concrete patch for concrete surfaces, joint and patching compound for dry wall surfaces, etc.). If the penetrated surface is a fire or smoke barrier, refer to "Installation of Fire Stopping Materials" in this section.

3.12. INSTALLATION OF FIRE-STOPPING MATERIAL:

A. General:

1. All fire and smoke rated walls and floors penetrated by electrical raceways, exposed conductors, etc. shall be properly sleeved and fire sealed. See Division 7 "Firestopping". All firestop system types shall be by same manufacturer to fullest extent possible.
2. All fire stopping will be installed in accordance to the U.L. rated system designed for the application.
3. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
4. Grout, Mortar, or Gypsum products shall not be installed in lieu of firestopping material specified here.

B. Sleeves:

1. Wall and floor opening shall be made as small as possible. Install sleeves during the erection of concrete or masonry walls. item. Sleeve shall be grouted in using material to match surrounding surface. Install electrical raceway, exposed conductors, etc. through sleeve and install fire stopping, intumescent material.

C. Penetrations - Provide Firestopping:

1. Where penetrations including conduit, cable, wire, or other elements which pass through one or both outer surfaces of a fire rated floor or wall.
2. Except for floor on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof.
3. Where a penetration occurs through fire-rated walls, or partitions of hollow-type construction, provide fire stopping to completely fill spaces around the penetration, on each side of the wall or partition.
4. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, fire stop annular space, if any, between sleeve and wall opening.

- D. Provide fire stopping to fill miscellaneous voids and blank openings in fire-rated construction where conduit, cable, wire or equipment has been removed.

3.13. SELECTIVE DEMOLITION AND ALTERATION OF EXISTING ELECTRICAL SYSTEMS:

A. Demolition Definitions:

1. Under demolition notes, several words and phrases are used. These shall be interpreted to mean as follows:
 - a. Abandon: Disconnect designated equipment and remove respective conductors back to source, such as a panelboard, distribution panel, switchboard, switchgear, etc. Alter respective legend accordingly.
 - b. Disconnect: Disconnect designated equipment and remove respective branch circuit wiring and affected exposed electrical equipment, such as boxes, raceways, control, etc.
 - 1.) Remove conductors back to source such as panelboard, etc. Alter respective legend accordingly.
 - 2.) Remove exposed raceway. When in unfinished areas such as mechanical equipment rooms, remove back to source. When in finished spaces, remove only that raceway which is exposed.
 - 3.) Where raceway is above an existing suspended, accessible ceiling and that ceiling grid is being reused or replaced, remove the exposed raceway in the affected area. Concealed homeruns are to remain and may be reused at Contractor's option.
 - c. Disconnect and Reconnect: Disconnect designated items, remove and store same where necessary, and then reinstall item and reconnect to existing branch circuit and control.
 - d. Remove Branch Circuit and/or Feeder: Remove conductor and respective raceway, fittings, boxes, etc.
- B. Where existing building construction is to be altered to accommodate the planned renovations and/or an addition(s), alter existing electrical service and distribution system, communications systems, fire alarm system, etc., as shown on the drawings and as required for proper operation of the altered system.
- C. Where existing accessible ceiling grid panels and grid support members are removed to permit the installation of new conduit, boxes, etc., it shall be the responsibility of this Contractor to reinstall the panels and grid support system to the satisfaction of the A/E. Damaged items shall be replaced at no cost to the Owner.
- D. Remove all existing affected electrical equipment, devices, fixtures, boxes, etc. which are not incorporated into or are not necessary for the operation of new and/or existing electrical systems, making sure that no remaining fixtures, devices, or appliances are left without service.
- E. Make sure that no remaining fixtures, devices, etc. within the renovated area or adjacent areas are left without service.
 1. Services and/or power outages and cutovers to be coordinated and Owner and done at Owner's convenience.

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2. Modify existing "systems" as required to accommodate added equipment.
 3. Remove abandoned accessible surface-mounted boxes and raceway. Abandoned accessible surface raceway shall be removed complete back to source.
 4. Where an abandoned raceway penetrates floor, slab, wall, etc. raceway shall be cut below the surface. Seal the opening and restore respective surface to match surrounding surface as directed.
 5. Where an abandoned raceway is not accessible, the raceway shall remain. Any accessible portions penetrating out of wall, floor, slab, etc. shall be cut off below the surface. Seal the opening and restore the respective surface to match the surrounding surface as directed.
 - a. Perform cutting and patching required for demolition in accordance with Division 01 and Division 02 section "Cutting and Patching".
 6. Flush mounted outlet boxes which are abandoned or used for junction boxes and are not concealed by new construction shall have openings covered by a blank, stainless steel plate.
 7. Where an existing distribution center is altered, provide a new, accurate, typed legend.
 8. Where work cannot be executed during normal working hours, this Contractor shall include in the Base Bid all necessary overtime pay to execute this contractors contract.
- F. All electrical equipment removed and not scheduled for reuse shall be turned over to the Owner at the construction site for salvage. All items deemed not salvageable by the Owner shall become the property of this Contractor and shall be removed from the site within 72 hours.

END OF SECTION 26 05 01

SECTION 26 05 19 - CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements, Basic Electrical Materials and Methods, and Electrical Identification sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this section include the following:
 - Copper conductors.
 - Fixture wires.
 - Tap type connectors.
 - Split-bolt connectors.
 - Wirenut connectors.
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
 - For service and power distribution (600 volts and less)
 - For lighting circuits.
 - For appliance and equipment circuits.
 - For motor-branch circuits.
 - For communications, control and alarm circuits.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. Codes and Standards:

1. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.
2. UL Compliance: Comply with requirements of all applicable UL standards.
3. UL Compliance: Provide wiring/cabling and connector products which are UL-listed and labeled.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wire, cable, and connector):
 1. Wire and Cable:
Anixter, Inc.
American Insulated Wire Corp.
AT&T Network Systems
Belden Wire & Cable Co.
Berk-Tek, Inc.
Brand-Rex Cable Systems
Carol Cable Co., Inc.
Southwire Co.
Triange Wire & Cable, Inc.
West Penn Wire/CDT
 2. Connectors:
AT&T Network Systems
Adalet, Inc.
AMP
Appleton Electric Co
Burndy Corp.
Hubbell, Inc., Wiring Devices Div.

IlSCO
Kearney.
3M Electrical Products Div.
O-Z/Gedney.
Panduit Corp.
Thomas & Betts Corp.

2.2 WIRES, CABLES, AND CONNECTORS

- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Unless noted otherwise on drawings or in these specifications, all conductors to be copper with conductivity not less than 98% at 2 deg F.
- B. Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings #12 AWG minimum size unless shown otherwise on Drawings. Where not indicated on Contract Documents, provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:
 - 1. Type THHN/THWN: For dry and wet locations; maximum operating temperature 75 deg C (167 deg F) for wet locations and 90 deg C (194 deg F) for dry locations.
- C. Cables: Provide UL-type factory-fabricated cables of sizes, ampacity ratings, materials and jacketing/sheathing for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements, NEC and NEMA standards.
 - 1. Communication conductors to be as required in other sections of these specifications (i.e. fire alarm system, , telephone and/or data system, etc.) or as shown on Drawings. Verify final requirements with representative equipment/system supplier prior to installation. Refer to individual specification sections or drawings for specific cable requirements. Verify final cable requirements with equipment/system supplier prior to installation.
- D. Connectors:
 - 1. General: Provide UL-type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which products are to be installed, and substrate which will support wires and cables. Notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to A/E.

3.2 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires and wiring connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
1. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables and other work.
 2. Pull conductors simultaneously where more than one is being installed in same raceway.
 3. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
 4. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
 5. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.
 6. Keep conductor splices to minimum and accessible.
 7. Install splices and tapes which possess equivalent and/or better mechanical strength and insulation ratings than conductors being spliced.
 8. Use splice and tap connectors which are compatible with conductor material.
 9. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.
 10. Conductors to be color-coded for phase identification, as follows:

| | | |
|----------------|-------|----------------|
| 208Y/120 Volts | Phase | 480Y/277 Volts |
|----------------|-------|----------------|

| | | |
|-------|---------|-------------------------|
| Black | A | Brown |
| Red | B | Orange |
| Blue | C | Yellow |
| White | Neutral | White with Black Stripe |
| Green | Ground | Green |

11. Nominal 20 amp branch circuit home runs to panelboards and/or control equipment longer than 100 feet to be not less than #10 AWG and sized to allow for voltage drop.
12. Conductors of #12 AWG size and larger to be stranded.
13. Conductors installed in locations subject to greater or less than normal ambient temperature to have insulation suitable and approved for such locations.
14. Number of conductors for various control, alarm, signal and communications circuits are intended to show general control scheme; actual number of conductors installed to be as required to accomplish specified results with provided equipment.
15. Before covers are finally installed on switchboards, switchgear, distribution panels, panelboards, etc., each feeder conductor shall be clearly and permanently identified as to conductor size and type of insulation. Use identification label or some other similar permanent form of identification as specified in Division 260533 - Electrical Identification.
16. Where home runs serving fluorescent fixtures are combined, the neutral shall be considered a current carrying conductor.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING

PART 1.-GENERAL

1.1. RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.
- C. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these specifications.

1.2. SUMMARY:

- A. Provide grounding of entire electrical installation as shown on Drawings and specified herein, and in accordance with Article 250 of N.E.C.
- B. Items to be grounded to include but not be limited to the following:
 - 1. Electrical service, it's equipment and enclosures.
 - 2. Metal raceways and enclosures.
 - 3. Neutral or identified conductor of electrical distribution system.
 - 4. Distribution panels and lighting, and appliance panelboards.
 - 5. Non-current carrying metal parts of fixed equipment such as motors, motor starter and controller enclosures, instrument cases, lighting fixtures, and equipment in hazardous locations.
 - 6. Metal columns, posts or partitions in or on which wiring devices, lighting fixtures, or electrical equipment are mounted.
 - 7. Metal building frames.
- C. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.3. QUALITY ASSURANCE:

- A. Codes and Standards:

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1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

PART 2.-PRODUCTS

2.1. MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):

Burndy Corporation
Cadweld Div; Erico, Inc.
Joslyn Corporation.
OZ Gedney.
Thermoweld, A Division of Continental Industries, Inc.
Thomas & Betts.

2.2. GROUNDING AND BONDING:

- A. Materials and Components:
 1. General: Except as otherwise indicated, provide electrical grounding and bonding systems; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC requirements and with established industry standards.
- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
- C. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.
- D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long. Select braid with holes sized for 3/8" diameter bolts, and protect braid with copper bolt hole ends.
- E. Surge Arrester: Electrical surge arrester, MOV type, 240/120-volt, 1 phase, 3 wire, 208Y/120-volt, 3 phase, 4 wire, 480Y/277-volt, 3 phase, 4 wire, for interior or exterior mounting.
- F. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers.

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- G. Ground Electrodes and Plates:
1. Grounding Electrodes: Steel with copper welded exterior, 3/4" dia. by 10 feet.
 2. Plate Electrodes: Sheet copper plate, 20-gage by 36" by 36", with 2 cable attachments sized for either #1/0 or #2/0 cables.
 3. Electrical Grounding Connections Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers.
- H. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correcting welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes.

PART 3.-EXECUTION

3.1. EXAMINATION:

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify A/E in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to A/E.

3.2. INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:

- A. General: Install electrical grounding and bonding systems in accordance with manufacturer's instructions and Article 250 of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Grounding Electrode System:
1. Where metallic underground water piping is available, it shall serve as part of the electrode system. At least one additional electrode of the types listed in Sections 250-81 and 250-83 of the National Electrical Code shall also be provided and shall be bonded to the water piping system.
 2. Where metallic underground water piping is not available, a minimum of two (2) electrodes of the types listed in Section 250-81 and 250-83 of the National Electrical Code shall be provided.
- D. Manner of Grounding:

1. Sizes and types of ground conductors, ground clamps, bonding jumpers, conduit, fittings and methods of securing same to obtain effective electrical continuity, when not indicated on Drawings, to be in accordance with NEC Article 250.
 2. All flexible metal raceway connections shall be bonded with a separate grounding conductor.
 3. Raceways for all conductors shall include a separate grounding conductor sized in accordance with the NEC or as shown on Drawings.
 4. Where raceways are equipped with wiring devices, such as surface raceway with receptacles, grounding conductor to be pulled in entire length of raceway and each wiring device connected to same.
- E. Provide exothermic welds for connecting grounding conductors to underground grounding electrodes where shown on Drawings.
- F. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
- G. Connect together system neutral, service equipment enclosures, exposed non-current metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- H. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.
- I. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.
- J. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- K. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.
- L. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.
- M. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- N. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

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3.3. FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, then retest to demonstrate compliance.

END OF SECTION 26 05 26

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Types of supports and anchors specified in this section include but are not limited to the following:
 - Two-hole conduit straps.
 - Lead expansion anchors.
 - Toggle bolts.
 - U-channel strut system.
 - Conduit cable supports.
- B. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division 26 sections.
- C. General:
 - 1. Raceway and boxes to be supported from building structure. Support from piping, ducts and equipment installed by Other Trades is prohibited unless prior approval is obtained from A/E .
 - 2. Raceways racked together and supported from building structure to be supported by U-shaped channel strut system.
 - 3. Spacing of supports and size of suspension rods to be in accordance with recommendations of respective system manufacturer.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

C. Codes and Standards:

1. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of electrical supporting devices.
2. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
3. UL Compliance: Provide supporting devices which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes and materials indicated below:
1. Manufacturers: Subject to compliance with requirements, provide one of the following:
Carlson, Div. of Lamson & Sessions (PVC).
Erico, Inc.
OZ/Gedney.
Thomas & Betts.
 2. One and two hole metal conduit straps to be stamped, heavy duty steel or malleable iron.
 3. Powder activated fasteners to be used on walls or floors in exposed areas, in shear stress only.
 - a. Use and location subject to prior approval of A/E.
 4. Steel hardware used on exterior of building to have approved corrosion resistant finish.
 5. Where PVC is used, respective hangers and supports to be compatible with same and as recommended by PVC manufacturer. Wire supports are prohibited.
 6. Steel raceway supports in metal stud walls and when fastened to steel bar joists to be steel and as manufactured by Erico, Inc. (Caddy Series) or equivalent.

7. Box supports in steel stud walls and when fastened to steel bar joists to be steel and as manufactured by Erico, Inc. (Caddy Series) or equivalent.
 8. Low voltage wiring for communications, etc. when installed above exposed or above accessible ceiling to be supported in steel J-hooks rated to support communication cables with appropriate steel beam, purlin and joist clips, as manufactured by Erico, Inc. (Caddy Series) or equivalent.
 9. Low voltage wiring for communications, etc. when installed in metal stud wall assemblies shall be protected and supported by use of metal stud grommets as manufactured by Erico, Inc. (Caddy Series) or equivalent.
- C. Anchors: Provide lead expansion anchors, toggle bolts, etc., as required by the specific application.
- D. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" O.C. on top surface, with standard finish, and with all necessary matching fittings.
1. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:
 - Allied Tube and Conduit Corp.
 - B-Line Systems, Inc.
 - OZ/Gedney.
 - Thomas & Betts.
- E. Conduit Cable Supports: Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for feeder conduit, wire quantity and type required; construct body of malleable iron casting with hot-dip galvanized finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which supporting devices are to be installed. Notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to A/E.

3.2 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers and anchors in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirement. Comply with requirements of NECA and NEC for installation of supporting devices.

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- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support raceways properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent of raceway work is indicated by drawings and schedules.
 - 1. All wiring to be in raceway unless noted otherwise on Drawings or in these Specifications.
 - 2. As shown on drawings, feeder and conduit routing, in general, are diagrammatic. Make revisions as required by field conditions during installation.
- B. Raceways include the following:
 - 1. Rigid metal conduit. (GRC)
 - 2. Electrical metallic tubing (EMT).
 - 3. Flexible metal conduit.
 - 4. Metal-clad cable. (MC)
 - 5. Liquidtight flexible conduit.
 - 6. Rigid nonmetallic conduit (PVC).
- C. Boxes, enclosures, and cabinets include the following:
 - 1. Device boxes.
 - 2. Junction boxes.
 - 3. Cabinets and hinged cover enclosures.
 - 4. Splice boxes.
 - 5. Pull boxes.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical products, of types, sizes and capacities required, that have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing electrical products similar to those required for this project.
- C. Codes and Standards:
 - 1. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical products specified in this section.
 - 2. UL Compliance: Comply with all applicable UL requirements pertaining to electrical products specified in this section. Provide only electrical products which are UL-listed and labeled.
 - 3. NEMA Compliance: Comply with all applicable NEMA requirements pertaining to electrical products specified in this section.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) required for each service. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways. Generic names for some types of raceways are shown in parentheses and are used interchangeably in these specifications and on drawings.
- B. Manufacturers: Subject to compliance with requirements, provide metal conduit and tubing of one of the following:
 - 1. Metal Conduit and Tubing:
 - AFC Cable Systems. (flexible steel, liquidtight)
 - Allied Tube and Conduit. (GRC, EMT, steel)
 - Anamet Electrical, Inc. (flexible steel, liquidtight)
 - Anixter, Inc. (flexible steel, GRC, EMT, steel)
 - Easco Aluminum Co. (rigid, EMT,)
 - Electriflex Co. (flexible steel, liquidtight)
 - LTV Steel Tubular Products Co. (GRC, EMT)
 - Perma-Cote Industries. (PVC)
 - Robroy Industries. (PVC,)
 - Triangle Wire and Cable, Inc. (GRC, EMT, steel)
 - Wheatland Tube Co. (GRC, EMT, steel)

- C. Electrical Metallic Tubing (EMT): Hot galvanized steel outside with an organic corrosion resistant inside coating and be produced in accordance with UL Standard #797 and ANSI C80.3.
- D. Rigid Steel Conduit (GRC): Hot dipped, galvanized, threaded type steel conduit produced in accordance with UL Standard #6 and ANSI C80.3. Factory threads shall be hot galvanized after cutting. Field cut threads shall be cold galvanized after cutting.
- E. Flexible Metal Conduit ("Flexsteel" or "Greenfield"): Provide conduit formed from a continuous length of spirally wound, interlocked galvanized strip steel.
- F. Liquidtight Flexible Metal Conduit ("Sealtight"): Provide conduit having an outer liquidtight, nonmetallic (PVC), sunlight-resistant jacket over an inner flexible metal core constructed from a continuous, interlocked, double wrapped, galvanized (in or out) strip of steel.

2.2 METALLIC CONDUIT BODIES AND FITTINGS

- A. Conduit Bodies: Provide metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded, conduit-entrance ends, removable covers and corrosion-resistant screws.
- B. Manufacturers: Subject to compliance with requirements, provide metallic conduit bodies and fittings to mate and match conduit used of one of the following:
 - Adalet, Inc.
 - Amp.
 - Appleton Electric Co.
 - Arlington Industries, Inc.
 - Easco Aluminum Co.
 - Hubbell, Inc.
 - O-Z/Gedney.
 - Spring City Electrical Manufacturing Co.
 - Steel City/Thomas & Betts.
- C. Rigid Metal Conduit Fittings: To be cast malleable iron, galvanized or cadmium plated.
- D. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
 - 1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - 2. 45 Degree or 90 Degree Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

- E. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or noninsulated throat.
- F. EMT Fittings: To be seamless steel tubing, steel set screw type. Die cast, pot metal couplings and connectors shall not be used.

2.3 NONMETALLIC CONDUIT AND DUCTS

- A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements which comply with provisions of NEC for raceways.
- B. Manufacturers: Subject to compliance with requirements, provide nonmetallic tubing and ducts of one of the following:

- Arnco Corp.
- Cantex, Inc.
- Carlson, Div. of Lamson & Sessions
- Cole-Flex Corp.
- JM Manufacturing Co.
- Osburn Associates, Inc.
- The George-Ingraham Corp.

- C. Rigid Nonmetallic Conduit (PVC): Provide conduit constructed of polyvinyl chloride (PVC) suitable for encased burial, direct burial or above ground use. Conduit shall be of the following types:
 - 1. Schedule 40 - for all types of applications.
 - 2. Schedule 80 - for all types of applications and where exposed to physical damage.
 - 3. Type DB (direct burial) - for use in direct burial installations where limited surface loading occurs or in concrete encased installations.
- D. PVC Conduit, Tubing Fittings and Boxes: Mate and match to conduit or tubing type and material.

2.4 NONMETALLIC CONDUIT BODIES AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide conduit bodies and fittings of one of the following:

- Carlson, Div. of Lamson & Sessions.
- Cole-Flex Corp.
- JM Manufacturing Co.
- The George-Ingraham Corp.

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2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide boxes, enclosures and cabinets of one of the following:

Adalet, Inc.
Appleton Electric Co.
Carlson, Div. of Lamson & Sessions.
Erickson Electrical Equipment Co.
Hammond Manufacturing Co.
Hoffman Engineering, Co.
Hope Electrical Products.
Hubbell Inc.
O-Z/Gedney.
Gran-Cal.
Raco, Inc.
Robroy Industries, Inc., Electrical Division.
Spring City Electrical Manufacturing Co.
Square D Co.
Steel City/Thomas & Betts.
Woodhead Industries, Inc., Daniel Woodhead Co.

- B. Device Boxes:

1. Switch and Receptacle Boxes - Concealed:

- a. Interior of Building, Dry Locations: Galvanized, stamped steel, 4" (min.) square box. Where installed in finished masonry walls, use masonry gangable type boxes (boxes with plaster rings not approved). Where 4" square box must be used with extension ring, use square cut tile wall type ring or an approved equal.
- b. Interior of Building, Wet Locations: Galvanized, stamped steel, 4" square box. Provide cast-metal face plates with spring-hinged watertight cover suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. The integrity of the weatherproof enclosure shall be maintained even when receptacle is in use per NEC Article 410-57.
- c. Exterior of Building: Galvanized, stamped steel, 4" square box. Provide cast-metal face plates with spring-hinged watertight cover suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. The integrity of the weatherproof enclosure shall be maintained even when receptacle is in use per NEC Article 410-57.

2. Switch and Receptacle Boxes - Exposed:

- a. Interior of Building, Dry Locations: Galvanized, stamped steel, 4" square or as shown on Drawings.
 - b. Interior of Building, Wet Locations: Provide corrosion-resistant cast-metal Type "FS" or "FD" device boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight cover suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. The integrity of the weatherproof enclosure shall be maintained even when receptacle is in use per NEC Article 410-57.
 - c. Exterior of Building: Provide corrosion-resistant cast-metal Type "FS" or "FD" device boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight cover suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. The integrity of the weatherproof enclosure shall be maintained even when receptacle is in use per NEC Article 410-57.
3. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is installer's code-compliance option.
 4. Device Box Support: Recessed device boxes shall be properly supported to not allow box to be pushed into wall cavity upon installation of drywall or other wall construction material. Use Caddy or equivalent metal stud clip and for side box support to eliminate box movement in wall.
 5. Shallow Applications: Galvanized, stamped steel, 4" square or octagon, 1-1/2" deep. For use walls with 1-1/2" min. furring. Provide plaster ring of depth required.
- C. Junction Boxes:
1. Dry Location: Galvanized, stamped steel, 4" square or octagon, with flat metal screw-on cover.
 2. Wet Location: Cast metal, 4" square or octagon with threaded conduit holes and flat cast metal screw-on cover sealed with a neoprene gasket.
- D. Cabinets and Enclosures:
1. Hinged Cover Enclosures: Steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
 2. Cabinets: Galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door

in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for free-standing equipment.

E. Pull and Splice Boxes (Low Voltage):

1. Pull Boxes: Provide boxes fabricated of heavy gauge steel and flanged on all sides to increase strength and rigidity. Furnish with screw mounted cover. When box is utilized in a wet or exterior location it shall be watertight, painted and the cover sealed with a neoprene gasket. Boxes shall be manufactured to the size indicated on drawings or when not indicated in compliance with the NEC. Over 600 volt covers will be permanently marked "DANGER HIGH VOLTAGE - KEEP OUT".
2. Splice Boxes: Provide boxes fabricated of heavy gauge steel and flanged on all sides to increase strength and rigidity. Furnish with screw mounted cover. When box is utilized in a wet or exterior location it shall be watertight, painted and the cover sealed with a neoprene gasket. Boxes shall be manufactured to the size indicated on drawings or when not indicated, in compliance with the NEC. Over 600 volt covers will be permanently marked "DANGER HIGH VOLTAGE - KEEP OUT". Splices shall be made through in-line splice kits or manufactured and mounted splice terminals integral to the splice box.
3. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which products are to be installed, and substrate which will support raceways. Notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to A/E.

3.2 INSTALLATION OF RACEWAYS

- A. General: Install raceways in accordance with manufacturer's written installation instructions, and in compliance with NEC, and NECA's "Standards of Installation". Install units plumb and level, and maintain manufacturer's recommended clearances.
- B. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
- C. Use boxes as supplied by raceway manufacturer wherever junction, pull or devices boxes are required.

- D. Installation of all raceways, in general, shall conform to the requirements listed in installation of conduits below.

3.3 INSTALLATION OF WIREWAY

- A. General: Install wireways and wireway components neatly, parallel with, or at right angles to walls of building. Install units plumb and level.
- B. Make changes in direction of wireway run with proper fittings, supplied by raceway manufacturer. No field bends of wireway sections will be permitted.
- C. Fasten J.I.C. wireway joint connections with the use of slotted hex head screws. Gasket each joint for oil-tight seal where lengths are joined.

3.4 INSTALLATION OF CONDUITS

- A. General: Install conduits concealed in new and existing construction work, either in walls, under slabs, or above hung ceilings. Where conduits can not be concealed in finished areas, use surface metal raceways, but only with prior approval of A/E.
 - 1. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
 - 2. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
 - 3. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in conduit every 200' linear run or wherever structural expansion joints are crossed.
 - 4. Use roughing-in dimensions of electrified units furnished by respective supplier. Rough-in conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
 - 5. Test conduits required to be installed, but left empty. Test with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
 - 6. In unfinished areas such as boiler rooms and mechanical equipment rooms, electrical rooms, storage rooms, etc. conduit may be exposed. Verify with A/E prior to installation.
 - 7. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

8. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
9. Size conduits to meet NEC. No conduit smaller than 3/4 inch shall be embedded in concrete or masonry. No conduit smaller than 3/4 inch shall be used on project.
10. Fasten GRC conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
11. Conduits are not to cross pipe shafts, or ventilating duct openings.
12. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceways runs above water and steam piping.
13. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
14. Complete installation of conduit before starting installation of cables/wires within conduit.
15. Conduits Installed Underground or Below Slab:
 - a. Metallic conduits installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
 - b. For floors-on-grade, install conduits under concrete slabs unless noted otherwise on drawings.
 - c. Install exterior underground conduits minimum of 36" below finished grade.
16. Conduits Installed in Concrete Slabs:
 - a. Place conduits between bottom reinforcing steel and top reinforcing steel.
 - b. Place conduits either parallel, or at 90 degrees, to main reinforcing steel.
 - c. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
 - d. Conduits crossing in slab must be reviewed for proper cover by A/E.
 - e. Embedded conduit diameter is not to exceed 1/3 of slab thickness.

17. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
18. Exposed Conduits:
 - a. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
 - b. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets
 - c. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0".
 - d. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
 - e. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.
19. Non-Metallic Conduits (PVC):
 - a. Make solvent cemented joints in accordance with recommendations of manufacturer.
 - b. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
20. Install expansion fittings in all conduits wherever structural expansion joints are crossed.
21. Properly support and anchor conduits for their entire length by structural materials. Conduits are not to span any space unsupported.
22. Standard electrical "handy" boxes, etc., shall not be permitted for use with surface conduit installations.
23. Pipe curbs or boots shall be used for conduits penetrating roof. Where possible serve roof mounted equipment through respective equipment roof opening.
 - a. Where roof must be penetrated, transpose to GRC prior to leaving building and use "seal-off" fitting.
24. Conduits to be sealed with approved "seal-off" fittings when entering and/or leaving the following areas:
 - a. Changes from inside to outside of building, if above grade.
25. Conduits to be supported from building structure.

- a. Conduits shall not be supported from ductwork, mechanical equipment, lay-in grid ceiling support system, etc.
 - b. Conduits not serving items on a piece of mechanical equipment shall not use that mechanical equipment as a supporting structure.
 - c. Conduits serving vibrating equipment, such as air handling units, motors, etc., shall be flexsteel or sealtite when transposing from the building structure conduit to the respective item of equipment.
 - d. Where conduit is mounted on mechanical equipment or ducts, do not penetrate side of equipment or ducts for fasteners without prior permission and coordination of mechanical contractor.
26. Provide nylon pull wire in all empty conduits longer than 10 feet.
- B. Type of conduit to be used in various locations is as follows, unless noted otherwise on Drawings:
1. Underground or Under Slabs in Contact with Earth: PVC 40.
 2. In Concrete Slab: PVC 40.
 3. Concealed within Interior Walls or Above Accessible Ceilings: EMT.
 4. Exposed Conduit When Subject to Possible Physical Damage: GRC.
 5. Exposed Conduit in Truck Wash Area: PVC
 6. Exposed Conduit Where Not Subject to Possible Physical Damage: EMT.
 7. Masonry or Block Walls: PVC or GRC.
 8. Concrete Encased Ductbanks: DB PVC.
 9. Exposed on Exterior of Building: GRC.
 10. Between outlet boxes and/or pullboxes located above hung or furred ceilings: EMT
 11. Between outlet box or pullbox to individual lighting fixture: Flexible metal or MC cable.
 12. Between Junction Box and Temperature Control Devices Located in Equipment in Mechanical Equipment Rooms: Flexible metal or MC cable.
 13. Motor Connections:
 - a. Outside: Liquid tight flexible metal.

- b. Inside Within 24" of Floor: Liquid tight flexible metal.
 - c. Inside, on Equipment Higher than 24 Inches above Finished Floor Dry
Location: Flexible metal.
 - d. Inside, on Equipment Higher than 24 Inches above Finished Floor Wet
Location: Liquid tight.
14. Connections to vibrating equipment, such as dry type transformers, air handling units, compressors, etc:
- a. Dry Location: Flexible metal.
 - b. Wet Location: Liquid tight.

3.5 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.
- F. Do not install boxes back-to-back in walls. Provide not less than 6" (150 mm) separation in non-fire rated walls and 24" (600 mm) in fire rated walls.
- G. Position recessed outlet boxes accurately to allow for surface finish thickness. Outlet box support shall not permit movement of box during drywall installation.
- H. Set floor boxes level and flush with finish flooring material. Verify exact location of floor boxes with Architect prior to rough-in.
- I. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- J. Box support shall be independent of conduit. Boxes shall be supported from building structure.
- K. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.6 GROUNDING

- A. Upon completion of installation work, properly ground raceways and electrical boxes and demonstrate compliance with requirements.

3.7 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.8 CLEANING

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 05 33

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of electrical identification work is indicated on drawings and schedules.
- B. Types of electrical identification work specified in this section include the following:
 - Buried cable warnings.
 - Electrical power, control and communication conductors.
 - Operational instructions and warnings.
 - Danger signs.
 - Equipment/system identification signs.
 - Arc flash hazard labeling.
- C. Refer to Division 01 general requirements section, "Identification Systems", for equipment and system nameplates, and performance data; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
 - 2. UL Compliance: Comply with applicable requirements of UL Std 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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- A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
- Brady, USA, Inc., Industrial Products Division.
 - Ideal Industries, Inc.
 - Panduit Corp.
 - Plymouth/Bishop Insulating Products.
 - Thomas and Betts Corp.
 - 3M Electrical Products Division.

2.2 ELECTRICAL IDENTIFICATION MATERIALS:

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Color-Coded Conduit Markers:
1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Except as otherwise indicated, provide lettering which indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.
 2. Colors: Unless otherwise indicated or required by governing regulations, provide white markers with black letters.
- C. Color-Coded Plastic Tape:
1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide.
 2. Colors: Unless otherwise indicated or required, provide tape colors to match those specified in Section 260519 "Wires and Cables".
- D. Underground-Type Plastic Line Marker:
1. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for underground cabling, direct buried, in raceways or in ductbanks; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of underground service. Provide line marker in full length of underground ditch or trench.
- E. Cable/Conductor Identification Bands:

1. General: Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification. Apply at each end of cable/conductor.
- F. Baked Enamel Danger Signs:
1. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red background with white lettering; 14" x 10" size except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP OUT, DO NOT TOUCH SWITCH, BURIED CABLE, ETC.
- G. Engraved Plastic-Laminate Signs:
1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated. Engrave with engraver's standard letter style of sizes and wording indicated. Punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 2. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
 3. Fasteners: Self-tapping stainless steel screws, except contact- type permanent adhesive where screws cannot or should not penetrate substrate.

2.3 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Use 5/32 inch lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area and conditions under which electrical connections for equipment are to be installed and notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to A/E.

3.2 APPLICATION AND INSTALLATION

- A. General Installation Requirements:

1. Install electrical identification products in accordance with manufacturer's written instructions, and requirements of NEC.
- B. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
- C. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- D. Conduit Identification:
 1. General: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method or in pipe basements or underground tunnels, apply color-coded identification on electrical conduit at changes in direction, at penetrations of walls and floors at 50-foot maximum intervals in straight runs and at 25-feet in congested areas. Except as otherwise indicated, use white as coded color for conduit.
- E. Underground Cable Identification:
 1. General: During back-filling/top-soiling of each exterior underground electrical, signal or communication cable, install continuous underground-type plastic line marker, located directly over buried cables, raceways or ductbanks at 6" to 8" below finished grade. Where multiple small cables or raceways are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
 2. Install line marker for underground cabling which is direct-buried, in raceways or in ductbanks.
- F. Cable/Conductor Identification:
 1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.
- G. Operational Instructions and Warning Signs:
 1. General: Install operational instruction and warning signs as required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.
- H. Danger Signs:

1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
 2. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property. Signs should contain emergency instructions where applicable.
- I. Equipment/System Identification:
1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide text, 3/8" high on 2" high by 3" wide sign. Use white lettering on green field for 208Y/120 volt equipment and white lettering on black field for 480Y/277 volt equipment on normal power. Use red lettering on white field for 208Y/120 volt equipment on emergency power and white lettering on red field for 480Y/277 volt equipment on emergency power. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
 - Electrical cabinets and enclosures.
 - Access panel/doors to electrical facilities.
 - Main electrical switches.
 - Panelboards.
 - Contactors and relays.
 - Disconnect switches for remotely located equipment.
- J. Arc Flash Hazard Labeling:
1. The contractor shall provide arc flash hazard labeling in accordance with NEC Section 110.16. Labeling shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of equipment. Labeling shall be in the form of self adhesive plastic label. Provide labeling for each unit of the following categories of electrical work:
 - Panelboards.
- K. Install signs and labeling at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with self-tapping stainless steel screws, except use adhesive where screws should not or cannot penetrate substrate.

END OF SECTION 26 05 53

SECTION 26 15 24 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.
- C. Division 26 Section "Raceways and Boxes " applies to work specified in this section.
- D. Division 26 Section "Electrical Identification" applies to work specified in this section.
- E. Division 26 Section "Conductors and Cables" applies to work specified in this section.

1.2 SUMMARY

- A. Extent of electrical connections for equipment is indicated by Drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section include but are not limited to the following:
 - 1. From electrical source to motor starters and/or disconnect switches.
 - 2. From motor starters and/or disconnect switches to motors.
 - 3. To lighting fixtures.
 - 4. To converters, rectifiers, transformers, inverters, rheostats, and similar current adjustment features of equipment.
 - 5. To grounds including earthing connections.
 - 6. To master units of communications, signal, alarm, clock, public address, sound, and video systems.
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 22 and other Division 26 sections, and are work of this section.
- D. Refer to Division 22 sections for control system wiring; not work of this section.

- E. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this section.

1.3 QUALITY ASSURANCE

- A. **Manufacturers:** Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. **Installer's Qualification:** Firms with at least 2 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. **Codes and Standards:**
 - 1. **NEC Compliance:** Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.
 - 2. **UL Compliance:** Comply with all applicable UL standards and provide electrical connection products and materials which are UL-listed and -labeled.
 - 3. **ETL Compliance:** Provide electrical connection products and materials which are ETL-listed and -labeled.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver electrical connection products wrapped in proper factory-fabricated type containers.
- B. Store electrical connection products in original cartons and protect from weather, construction traffic and debris.
- C. Handle electrical connection products carefully to prevent breakage, denting, and scoring finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products of one of the following (for each type of product):
 - Adalet.
 - AMP.
 - Burndy Corporation.
 - Hubbell, Inc.

Ideal Industries, Inc.
IlSCO.
OZ/Gedney
Thomas & Betts.
3M Company.

2.2 MATERIALS AND COMPONENTS

- A. General: For each electrical connection provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire-nuts, and other items and accessories as needed to complete splices and terminations.
- B. Metal Conduit, Tubing and Fittings:
 - 1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) required for each type service. Provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 16 Section "Raceways".
- C. Wires, Cables, and Connectors:
 - 1. General: Provide wires, cables, and connectors complying with Division 16 Section "Conductors and Cables".
 - 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20 deg C (68 deg F).
 - 3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
 - 4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wirenuts and cable ties as recommended for use by accessories manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area and conditions under which electrical connections for equipment are to be installed and notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to A/E.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. When making connections to screw terminals with #10 or smaller stranded wire, the frayed end shall be taped or enclosed by a piece of the conductor insulation.
- E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- F. Prepare wires/cables, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where wires/cables are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim wires/cables as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
- I. Provide flexible conduit for motor connections, and other electrical and/or mechanical equipment connections, where subject to movement and vibration.
- J. Provide liquid-tight flexible conduits for connection of motors and other electrical and/or mechanical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:
 - Exterior location.
 - Moist or humid atmosphere where condensate will accumulate.
 - Corrosive atmosphere.
 - Water spray.
 - Dripping oil, grease, or water.
 - When within 24 inches of floor.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION 26 15 24

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent of panelboard and enclosure work including cabinets and cutout boxes is indicated by drawings and schedules, and as specified herein.
- B. Types of panelboards and enclosures required for the project include the following:

Lighting/Appliance panelboards.
- C. Refer to other Division 26 sections for wires/cables, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards and enclosures. Submittal data shall clearly define:
 - 1. Panel voltage, ampacity and phase data.
 - 2. Breaker arrangement, sizes and types.
 - 3. Short circuit interrupting capacities.
 - 4. Panel designation.
 - 5. Distribution panelboard submittals shall include a one-line diagram of busing (showing size) and protective devices (showing size, poles, circuit breaker interrupting capacity, etc.) Drawings to be done in professional manner to satisfaction of A/E.
 - 6. Lighting/appliance panelboard submittals show size and number of poles of circuit breaker protective devices and their interrupting capacity. Drawings to be done in professional manner to satisfaction of A/E.

7. Circuit breaker Time Current Characteristic (TCC) curve number for each circuit breaker size and type specified in 11" x 17" format and electronic data file in PDF format.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.
- C. Codes and Standards:
 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to installation, and construction of electrical panelboards and enclosures.
 2. UL Compliance: Provide panelboard units which are UL-listed and labeled.
 - a. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL markings which indicate that they are suitable for special type of use/application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide panelboard products of one of the following (for each type and rating of panelboard and enclosure):

Cutler-Hammer
General Electric Company.
Siemens
Square D/Schneider Electric
- B. All panelboards to be of same manufacturer.

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete

installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.

1. All panelboards to be equipped with separate grounding bus.
 2. Panelboards consisting of two or more sections to have matching tub and trim dimensions.
 3. Where a panelboard is used for service entrance, provide same with UL label indicating that it is suitable for use as service entrance application.
 4. Multiple pole breakers are to have common trip.
 5. Panelboards with fusible switches are to be equipped with fuses of sizes and types indicated on Drawings.
- B. Distribution Panelboards: Provide dead-front safety type power distribution panelboards with switching and protective devices in quantities, types, and arrangement shown; equip with copper bus bars with not less than 98-percent conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards. Units to be front access, front connected type. Bus to be extended full length of enclosure.
- C. Lighting/Appliance Panelboards: Provide dead-front safety type lighting/appliance panelboards with switching and protective devices in quantities, types and arrangements shown; equip with copper bus bars, full-sized neutral bar, with bolt-in type, quick-make, quick-break, circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards.
- D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types required with code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.
1. Front or trim construction shall be door-in-door type with both doors having flush locks and concealed piano door hinges allowing them to swing open freely without having to mechanically unfasten screws. All panels shall be keyed alike.
- E. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and RMS symmetrical interrupting ratings of 22,000 amperes for 208/120 volt or 240/120 systems, unless noted otherwise on the Drawings. Circuit breaker interrupting ratings shall be for fully rated distribution systems. Series rated circuit breakers are not permitted. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and

operating in an ambient temperature of 40 deg C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated. Circuit-breakers to be bolted type unless noted otherwise on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify A/E in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to A/E.

3.2 INSTALLATION OF PANELBOARDS

- A. Install panelboards and enclosures, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.
- D. Provide accurate, typed legend for each panelboard.
- E. Where an existing panelboard is altered, update legend by supplying new, accurate, typed legend for each panelboard altered.
- F. Arrange branch circuits to achieve best possible phase balance.
- G. Where flush mounted panelboards are installed, provide an additional five (5) 3/4" conduits with nylon pullstrings from panelboard enclosure stubbed above the accessible ceiling or to an access panel, if drywall ceiling, directly above the panelboard.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization:
 - 1. Check all accessible connections to manufacturer's tightening torque specifications.
 - 2. Check for electrical continuity of circuits, and for short-circuits.

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3.4 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finishes.
- C. Clean both the interior and exterior of the panelboard enclosure so that it is free from dust and debris.

3.5 DEMONSTRATION

- A. Subsequent to wire and cable connections, energize panelboards and demonstrate functioning in accordance with requirements.
- B. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. This section includes the following:
 - Grounding Type Receptacles
 - Ground-fault Circuit Interrupter Receptacles (GFCI)
 - Wall Plates
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 26 Section "Disconnect Switches" for devices other than snap switches and plug/receptacle sets used as disconnects for motors.
 - 2. Division 26 Section "Electrical Identification" for requirements for legends to be engraved on wall plates.

1.3 SUBMITTALS

- A. Product data for each type of product specified.
- B. Samples of those products indicated for sample submission in A/E's comments on product data submittal. Include color and finish samples of device plates and other items per A/E's request.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following codes.
 - 1. NFPA 70 "National Electrical Code".
 - 2. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

1.5 SEQUENCE AND SCHEDULING

- A. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Cooper Wiring Devices – (receptacles)
Hubbell Inc. - (receptacles)
Pass and Seymour Inc. - (receptacles)

2.2 WIRING DEVICES

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications shown on Drawings which are UL listed and which comply with all applicable UL and NEMA standards. Color and/or finish of wiring devices to be ivory unless otherwise noted or directed by A/E.
- B. General Purpose Receptacles: Provide 20 amp, 125 volt, grounding type, heavy duty, specification grade, duplex receptacles with the following features:
1. One-piece brass integral ground strap.
 2. Ground retention clips.
 3. Bypass contact.
 4. Square head, 10-thread brass center rivet.
 5. I.D. marking.
 6. Barbed assembly arms.
 7. Back wired ground terminal.
 8. External bundling terminals.
 9. Deep nylon body design.
 10. Reinforced thermoplastic back.
 11. Meets or exceeds UL 498 NEMA WD-1 and Federal Specifications WC-596.

- C. Ground-Fault Interrupter (GFI) Receptacles: Provide "feed-thru" type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. GFI receptacle features shall be identical to those specified for general purpose receptacles above. Provide unit designed for installation in a 2-1/8" deep outlet box without adapter.

2.3 WIRING DEVICE ACCESSORIES

- A. Wall Plates: Single and combination, of types, sizes, and with ganging and cutouts as required by diagrammatic layout shown on drawings or as required by A/E. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates color to match wiring devices except as otherwise indicated or required by code. Provide wall plates with engraved legend where indicated below. Conform to requirements of Section "Electrical Identification". Provide plates possessing the following additional construction features:
 - 1. Material and Finish: Nylon, ribbed. Verify finish with A/E.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which wiring devices are to be installed. Notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to A/E.

3.2 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

- A. Install wiring devices and accessories in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Install wallplates after painting work is completed.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to

comply with tightening torques specified in UL Stds 486A. Use properly scaled torque indicating hand tool.

- G. Grounding type receptacles shall be installed with the grounding prong opening in the up position. Horizontally mounted grounding type receptacles shall be installed with the neutral prong opening in the up position.
- H. When making connections to wiring devices with #10 or smaller stranded wire, the frayed end shall be taped or enclosed by a piece of the conductor insulation.

3.3 PROTECTION

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.4 FIELD QUALITY CONTROL

- A. Testing: Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.
- B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

3.5 CLEANING

- A. Testing: Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.
- B. General: Clean devices, device outlet boxes, and enclosures. Replace stained or painted wall plates or devices.

END OF SECTION 26 27 26

SECTION 26 51 00 - INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 26 Basic Electrical Requirements and Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.
- B. Types of interior lighting fixtures in this section include the following:
Fluorescent.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions on each type interior building lighting fixture and component. Components include, but are not limited to lamp and ballast information.
- B. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. All fixture shop drawings required must be submitted at one time. Failure to submit all fixture shop drawings at once is cause for rejection of entire submittal.
- C. Separate ballast cut sheets for each type of ballast provided shall be submitted with lighting fixture booklets. Shop drawings shall clearly indicate which ballast type is provided with each fixture. Refer to Division 26 Section Emergency Lighting for fluorescent emergency ballast requirements.
- D. Separate lamp cut sheets for each type of lamp provided shall be submitted with lighting fixture booklets. Shop drawings clearly indicate which lamp type is provided with each fixture.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with interior lighting fixture work similar to that required for this project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 410, and 510 as applicable to installation, and construction of interior building lighting fixtures.
 - 2. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components which are UL-listed and labeled.
 - 3. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.
- B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of interior lighting fixtures with other work.
- B. Sequence interior lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products as shown on Drawings (for each type of interior lighting fixture).

2.2 FIXTURES

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated on Drawings; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy-efficient ballasts, and wiring. Ship fixtures factory-assembled, with those components required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise.
- B. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring as follows:
- C. NEC Type AF for 120 volt, minimum No. 18 AWG.
- D. NEC Type SF-2 for 277 volt, minimum No. 18 AWG.
- E. Fluorescent Lamp Electronic Ballasts: Provide electronic fluorescent lamp ballasts unless shown otherwise on Drawings, with the following characteristics:
 - 1. Fluorescent fixture ballasts to be CBM-ETL approved, UL labeled, "P" Type 1 outdoor rated.
 - 2. Operate at frequencies higher than 25 kHz with less than 2% lamp flicker.
 - 3. Contain no PCB material.
 - 4. Comply with requirements of UL Class P for thermal protection.
 - 5. Contain an "A" sound rating for quiet operation.
 - 6. Maintain the minimum ballast efficacy factors as established by the National Appliance Act 100-357.
 - 7. Restrict total harmonic distortions of the input current as generated by the ballast to a maximum of 10%.
 - 8. Operate in minimum ambient temperature of 0 deg F.
 - 9. Comply with requirements of IEEE 587 Category A for surge or transient voltage protection.
 - 10. Comply with requirements of FCC Part 18, Subpart J, pertaining to suppress radio frequency interference (RFI) and electromagnetic interference (EMI).
 - 11. Tolerate line voltage variations of 5% above or 7% below nameplate rating.

12. Contain a three year warranty from date of manufacturing against defects in material and workmanship. This warranty shall include a ten dollar (\$10.00) per ballast replacement labor allowance.
13. Specific ballasts shall be designed to operate with specific lamps. Multi-duty ballasts are not acceptable.
14. Achieve a minimum power factor of 98%.
15. Ballast case temperatures shall not exceed 25 deg C rise over 40 deg C ambient.
16. Ballasts shall be instant start type (parallel lamp operation) and maintain a lamp current crest factor of less than 1.7.
17. Fluorescent fixture electronic ballasts to be CBM-ETL approved, UL labeled.
 - a. Manufacturer: Osram or equivalent as manufactured by Advance or Universal unless noted otherwise on Drawings.
 - b. Ballasts for a particular category of fixture (i.e. "A" units) to be of same manufacturer and style.
 - c. Ballasts to be manufactured within 6 months of fixture installation.

F. Lamps:

1. General:
 - a. This contractor shall provide lamps for each fixture type as shown on fixture schedule.
 - b. Color of lamps shall be as shown on fixture schedule.
 - c. Lamps shall be as manufactured by Osram Sylvania (OSI). Equivalent lamps as manufactured by General Electric (GE) and Phillips Lighting Company are acceptable.
2. Fluorescent Lamps:
 - a. Linear Fluorescent Lamps:
 - 1) T8 fluorescent lamps shall be Octron (OSI) or equivalent as manufactured by GE or Phillips with a minimum 20,000 hour rated life.

- 2) T5 and T5HO fluorescent lamps shall be Pentron (OSI) or equivalent as manufactured by GE or Phillips with a minimum 20,000 hour rated life.

G. Interior Lighting Fixture Types:

1. General: Various fixture types required are indicated on Drawings. Fixtures must comply with minimum requirements as stated herein.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify A/E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to A/E.

3.2 INSTALLATION OF INTERIOR LIGHTING FIXTURES

- A. All fixtures to be supported securely from building structure and/or walls and the responsibility for mounting same shall be that of this Contractor.
 1. Wall mounted fluorescent fixtures to have additional 1/4" toggle bolt (or equivalent) support at each end of module.
 2. Where lighting fixtures are installed below ductwork, this Contractor shall provide additional horizontal support independent of the ductwork and secure same from the building structure.
- B. It shall be the responsibility of this Contractor to coordinate with other affected trades the installation of all fixtures and to furnish and install plaster frames and other hanging devices where required for each type of ceiling within building.
- C. Instruct Owner in setting, operation and maintenance of any lighting control equipment such as time clocks, relays, dimmers, pushbuttons, etc.
- D. Provide separate grounding conductor in flexible metal conduit between outlet box and lighting fixture and ground respective lighting fixture with same.
- E. Mounting, support and connection of lighting fixtures furnished by Owner or Other Divisions to be the responsibility of this Contractor unless noted otherwise on the Drawings.

3.3 FIELD QUALITY CONTROL

- A. At Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by A/E.
 - 1. Refer to Division 01 sections for replacement/restoration of lamps in interior lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.
- B. Furnish stock or replacement lamps amounting to 15%, but not less than four (4) lamps in each case, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space.

3.4 ADJUSTING AND CLEANING

- A. Clean interior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
- B. Protect installed fixtures from damage during remainder of construction period.
- C. Protective plastic bags shall remain on fixtures with parabolic type lenses until final building cleaning is complete. If protective bags are removed prior to final building cleaning and lenses become dirty, dusty, etc., this Contractor shall clean lenses and restore to original condition as directed by the A/E.
- D. Where existing fixtures are removed under demolition phase of project and reinstalled, this Contractor shall clean fixture housing, reflector and lens and relamp with new lamps to match those previously installed except with color rendering comparable to new fixture/lamps being installed or as directed by A/E.

3.5 DEMONSTRATION

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 51 00